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ANNUAL EVALUATION OF CONNECTICUT'S INSPECTION/MAINTENANCE PROGRAM

2012

FINAL REPORT

Prepared for:

Connecticut Department of Energy and Environmental Protection

Prepared by:

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Executive Summary

As required by the Clean Air Act Amendments of 1990, the Connecticut Department of Energy and Environmental Protection (DEEP) in partnership with the Connecticut Department of Motor Vehicles (DMV) conducts periodic evaluations of its enhanced Motor Vehicle Inspection and Maintenance (I/M) Program. This report is being submitted in fulfillment of the requirements to provide an annual I/M report per 40 CFR 51.366. This report addresses data collected from January 1, 2012 through December 31, 2012. As evidenced by the high compliance rate, limited fraud and low waiver rate, this report demonstrates that Connecticut's I/M program effectively achieves the expected air quality benefits.

The United States Environmental Protection Agency (EPA) provided a checklist (Appendix A), which identified the data elements to be included in this report. The 2012 data elements are compiled in Appendix B and correspond to the indexing system used in EPA's checklist. Due to the structure of Connecticut's I/M program, the following requirements of the attached checklist are not applicable: (a)(2)(xiii), (xiv), (xv), (xvi), (xvii), (xviii), (xx) and (5); (b)(3)(ii), and (iv); (4)(iii), (6), (7); (d)(3) and (4).

The I/M program, designed to identify vehicles that emit pollutants that exceed acceptable standards and require such vehicles to get repaired, is an important part of the strategy to ensure that Connecticut is positioned to attain and maintain the 1997 National Ambient Air Quality Standard (NAAQS) for Ozone (i.e., smog). Connecticut's I/M program, which dates back to 1983, has a long history of effectively reducing vehicle emissions and results in more emission reductions than any other state-implemented reduction strategy. Current estimates indicate that in 2010, this program would have provided approximately 19 of the 200 tons per day of air pollutant reductions that are included in Connecticut's 2008 Ozone Attainment Demonstration State Implementation Plan. The emission reductions resulting from this program are an integral part of Connecticut's air quality attainment efforts, and important as part of a balanced strategy that includes reductions from stationary, area and mobile source sectors to ensure that Connecticut attains the Ozone NAAQS. EPA has since strengthened the Ozone NAAQS in 2008 resulting in Connecticut's proposed designation of nonattainment for the new 75 ppb eight-hour ozone standard. EPA is expected to issue an even more stringent Ozone NAAQS by 2014. If EPA does so, Connecticut will need to achieve even greater emission reductions from motor vehicles.

All of Connecticut continues to experience elevated ozone concentrations during the summer months. While in-state sources of air pollution such as cars and power plants contribute to ozone formation, much of the ozone and precursor emissions transported into Connecticut originate from sources located in upwind states. For example, during elevated ozone episodes in Connecticut, air quality measured at the state border with New York frequently exceeds the Ozone NAAQS, which is indicative of significant air pollution transport. It is therefore imperative to address transport challenge to assure clean air for Connecticut's citizens.

This report focuses on the effectiveness of Connecticut's I/M program. Key program highlights include:

- In May 2011, following a comprehensive evaluation and selection process, DMV entered into a new agreement with a private contractor, Applus, for the next phase of the Connecticut I/M program. This new program:
    - Began with a rolling implementation and is now fully operational;
    - Maintains the same overall structure and requirements while including upgraded equipment and computer systems;
    - Addresses many of the challenges faced by the previous system and ensures Connecticut's I/M program will continue to comply with statutory and regulatory mandates, while achieving clean air benefits.
- In 2012, over 98% of the vehicles subject to testing were in compliance with I/M program requirements. The overall compliance rate in Connecticut exceeds the compliance rate of 96% specified in Connecticut's State Implementation Plan. Connecticut actively investigates non-compliance and assesses fines for late inspections. In 2012, respectively, 162,665 fines were assessed for late inspections. Linking registration to compliance in addition to late inspection fines contribute to Connecticut's very high compliance rate.
- Approximately 11% of vehicles failed their initial emissions test and 12% of these vehicles also failed their first retest in 2012. Failure rates under the decentralized I/M program are equal to or higher than failure rates recorded under centralized I/M programs. Ongoing outreach efforts designed to decrease failure rates will continue to be enhanced.
- DMV performs extensive quality assurance checks on the program. Evaluation of these quality assurance data demonstrates that the program performs accurate inspections.
- Audits were conducted at all stations as part of an extensive anti-fraud program. 438 video surveillance audits were conducted during 2012. Less than 0.2% of the inspections in Connecticut are suspect, which is far lower than many other states' I/M programs. Connecticut's anti-fraud efforts are models for other I/M programs.

Connecticut consistently conducts thoughtful analysis of its vehicle inspection and maintenance program, which has led to numerous enhancements. In the past year, several initiatives, such as instituting more safeguards to ensure correct vehicle identification numbers and review of the fleet testing program, are being implemented to further strengthen the program. A full iteration of the changes to the program can be found in Section 8 of this report. Connecticut's analysis repeatedly has demonstrated the program produces the expected air pollutant reductions. DEEP and DMV continue to evaluate opportunities to improve the program and cost effectively increase the air quality benefits.

1.0 Introduction

This report presents an analysis of data collected in Connecticut's Motor Vehicle Inspection and Maintenance (I/M) program in 2012 to meet the United States Environmental Protection Agency's (EPA) annual reporting requirements of 40 CFR Part 51.366. In an I/M program, vehicles are periodically inspected, and those with evidence that they exceed design emission standards must be repaired. I/M programs are mandated by the Clean Air Act and were limited to areas that EPA designated as "serious" or "severe" non-attainment for the ozone National Ambient Air Quality Standard (NAAQS). Connecticut's program, which dates back to 1983, has a long history of effectively reducing vehicle emissions and is an important part of the strategy to ensure that Connecticut is positioned to attain the NAAQS for ozone. Since Connecticut's ozone levels exceed the 2008 ozone NAAQS, additional emission reductions from all sectors, including motor vehicles, remain critical.

Connecticut's I/M program results in more emission reductions than any other state implemented reduction strategy. Current estimates indicate that in 2010, this program would have resulted in approximately 19 of the 200 tons per day of air pollutant reductions that are included in Connecticut's 2008 Ozone Attainment Demonstration[1]. The emissions reductions resulting from this program are an integral part of Connecticut's air quality attainment efforts and important as part of a cost effective and balanced strategy that includes reductions from stationary, area and mobile source sectors.

Emissions reduction determinations are estimated using modeling that is approved by the EPA. The most recent State Implementation Plan (SIP) Revision, which addresses the I/M program, was developed using MOBILE6.2, the model which was approved for use by EPA at that time. EPA has since updated its modeling platform and has begun implementing a new model known as the Motor Vehicle Emissions Simulator (MOVES). States are now required to use MOVES for attainment demonstrations, for hot spot analysis and for regional conformity.

Connecticut's I/M program identifies vehicles that have been tampered with, or have received improper maintenance. These vehicles must be repaired until they comply with emission standards. The Connecticut Department of Motor Vehicles (DMV) oversees the I/M program operated by a private contractor; the Connecticut Department of Energy and Environmental Protection (DEEP) ensures that the program achieves the air quality benefits as outlined in Connecticut's SIP.

The original program implemented in 1983 subjected vehicles to two inspections – an idle test where exhaust concentrations of hydrocarbons (HC) and carbon monoxide (CO) were measured while the vehicle was idling and a visual inspection for the presence of the catalytic converter. Vehicles with gross vehicle weight ratings (GVWR)

1 The 2008 Ozone Attainment Demonstration details Connecticut's strategies designed to bring the state's air quality into compliance with the 1997 8-hour ozone NAAQS of 84 ppb.

of 10,000 pounds (lbs.) or less were included in the program. In 1998, Connecticut substantially enhanced its existing I/M program to meet new SIP requirements, as well as federal requirements for I/M improvements. The emission test changed from an unloaded idle emission test to a loaded-mode test (ASM2525[2]). With this change, Connecticut began evaluating emissions of oxides of nitrogen[3] (NO_x) along with HC and CO. The loaded-mode test uses a chassis dynamometer to simulate on-road driving. If the vehicle could not be safely tested on a dynamometer, it received a pre-conditioned two-speed idle (PCTSI) test. In addition, the inspection included a gas cap pressure test to check to see if the gas cap holds pressure. Leaking gas caps are a major source of evaporative HC emissions. The program continued to include a visual emission control component check. Also, at this time Connecticut began diesel testing.

In 2003, Connecticut again made substantial revisions to the program. The inspection network was changed from a centralized system with about 25 inspection stations to a decentralized system with a contractor equipped limit of 300 stations[4]. The goals of these changes were to improve customer convenience to the public by decreasing the waiting time for emissions testing, directly involve the repair industry with emissions testing, and enhance opportunities for small business development. In addition, 1996 and newer gasoline- powered models started receiving on-board diagnostic (OBD) tests[5], instead of ASM2525 or PCTSI exhaust emissions tests. All 1996 and later model year light-duty vehicles sold in the United States contain the second generation of OBD, termed OBDII. Connecticut also performs OBD tests on diesel powered vehicles that are model year 1997 and newer having a GVWR of 8500 lbs. and less. OBDII systems can detect malfunctions or deterioration of emission control components, often well before the motorist becomes aware of any problem. Inspecting vehicles by reading the OBDII system codes can identify vehicles with serious emission control malfunctions more accurately and cost-effectively than traditional tailpipe tests, and help technicians diagnose and repair those malfunctions. Diesel powered vehicles having a GVWR of 10,000 lbs. or less, receive tests for excessive exhaust smoke, if they cannot receive OBDII tests. Evaluating OBDII test results presents special challenges, since tailpipe emission results are not available for each vehicle.

In 2011, the state embarked upon a new program with upgraded equipment and computer systems to correct challenges faced the previous system. While the new program introduced many improvements, as part of this new program, DMV is working with their contractor, Applus, to evaluate and implement additional new improvement

2 The ASM2525 or Acceleration Simulation Mode test measures HC, CO and NO emissions while the vehicle is driven at a constant speed (25 MPH) on a treadmill-like device termed a dynamometer.

3 Nitric oxide (NO) is measured as a surrogate for oxides of nitrogen (NO_x). NOx along with HC emissions are considered to be the major ozone precursors.

4 This number dropped from 300 stations to 250 stations by the end of 2008. At the end of 2012, there were 222 stations in the network.

5 1997 and newer light-duty diesels (<8500 lbs. GVWR) also get OBD inspections.

measures to maximize the cost effectiveness and benefits of the program.

The methodology for this report has utilized data on different inspection components to determine if the appropriate number of vehicles are being failed and repaired. This multifactorial approach is consistent with the purpose of the OBDII system, since it assures that Connecticut is identifying, and requiring the repair of vehicles that exceed design emission standards by more than 50%, as required by the EPA. Evaluating decentralized inspections requires a comprehensive assessment of how well stations comply with mandated inspection procedures. Generally, there are greater opportunities for fraud in decentralized facilities, because there are more stations that need policing. Using data and procedures provided by the DMV, de la Torre Klausmeier Consulting, Inc. (dKC) assessed effectiveness and enforcement of Connecticut's program**.**

2.0 Observed Failure Rates for Gasoline-Powered Vehicles

Failure rates for gasoline-powered vehicles were calculated using test results from I/M test stations. Below is a brief description of the criteria used to determine if a vehicle passes or fails inspection.

Pass/Fail Criteria

ASM2525 or Pre-Conditioned Two-Speed Idle (PCTSI) Inspection (pre-1996 vehicles): Vehicles fail if they exceed Connecticut's cut points or emissions standards. For the ASM2525 test, HC, CO and NOx emissions are evaluated. For the PCTSI test, HC and CO emissions are evaluated. Connecticut uses EPA's recommended cut points for the ASM2525 and PCTSI tests.

Gas Cap Test: Vehicles fail if their gas cap cannot hold pressure. Beginning in November 2004, only pre-1996 light-duty vehicles receive gas cap tests. The OBDII system adequately tests a vehicle's evaporative system on most 1996 and newer vehicles.

OBDII Inspection: 1996 and newer light-duty vehicles are subject to an OBDII inspection. The emissions test system is plugged into the OBDII connector and information on the status of the vehicle's OBD system is downloaded. Vehicles fail the OBDII inspection if they have the following problems:

- Malfunction Indicator Lamp (MIL[6]) is commanded-on;
- MIL not working (Termed Key-On Engine-Off, KOEO, failure[7]);
- The number of readiness monitors that are not ready exceed EPA's limit[8];
    - 1996-2000 models: Two monitors are allowed to be not ready;
    - 2001+ models: One monitor is allowed to be not ready;
- OBD Diagnostic Link Connector (DLC) damaged; or
- Vehicle could not communicate with the Connecticut inspection system.

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6 MIL is a term used for the light on the instrument panel, which notifies the vehicle operator of an emission-related problem. The MIL is required to display the phrase "check engine" or "service engine soon" or the ISO engine symbol. The MIL is required to illuminate when a problem has been identified that could cause emissions to exceed a specific multiple of the standards the vehicle was certified to meet.

7 The Key-On Engine-Off (KOEO) determines if the MIL bulb is working. The bulb should illuminate when the vehicle is turned on but not started.

8 OBDII systems have up to 11 diagnostic monitors, which run periodic tests on specific systems and components to ensure that they are performing within their prescribed range. OBDII systems must indicate whether or not the onboard diagnostic system has monitored each component. Components that have been diagnosed are termed "ready", meaning they were tested by the OBDII system.

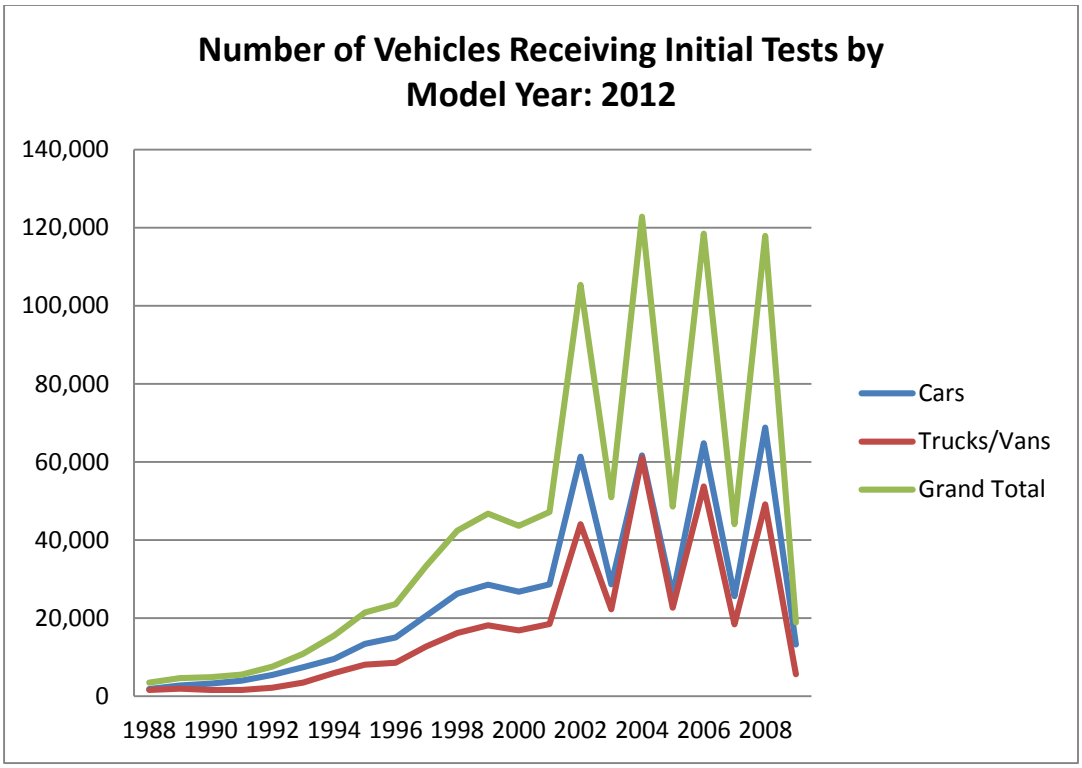
Summary of Fail Rates for Gasoline-Powered Vehicles

Following is a summary of test results from January 1, 2012 to December 31, 2012. In 2012, 1,055,739 gasoline-powered vehicles received initial tests.

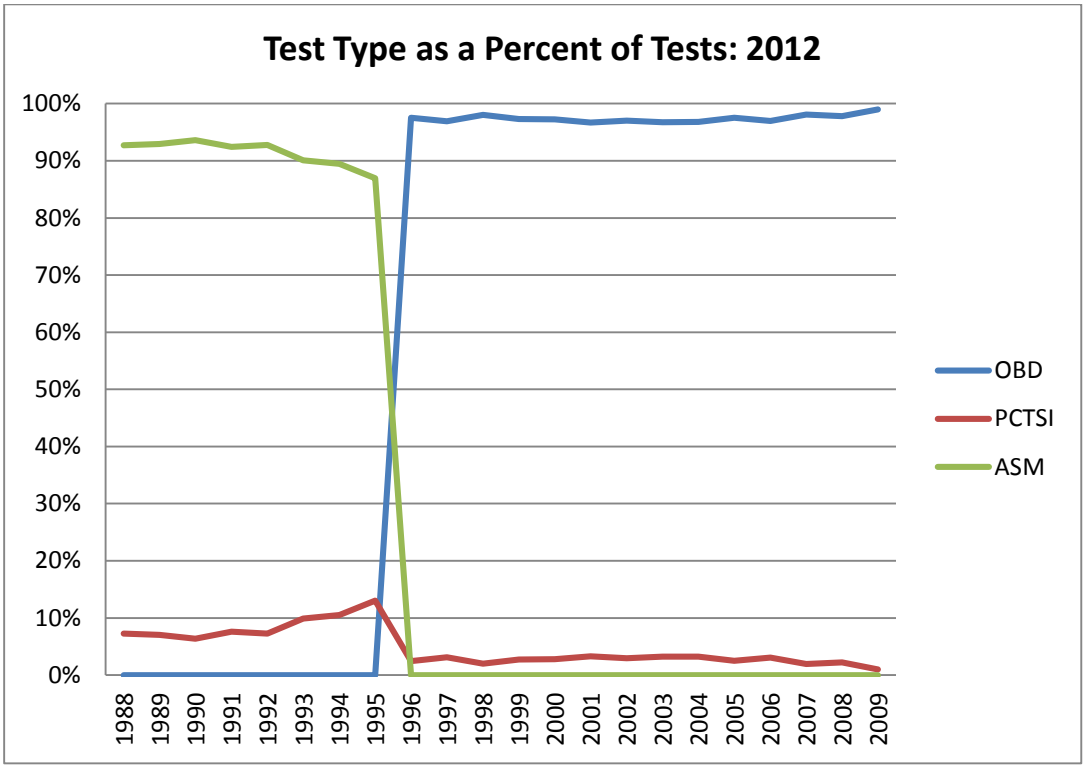
Test Type	Parameter	2012 Result
OBD	% Fail Initial (any reason)	10%
	% Fail for MIL Commanded-on	5.9%
	% Fail First Retest	10%
ASM	% Fail Initial	9%
	% Fail First Retest	45%
PCTSI	% Fail Initial	11%
	% Fail First Retest	13%
Gas Cap	% Fail Initial	7.9%
	% Fail First Retest	6.1%
All Tests	% Fail Initial	11%
	% Fail First Retest	12%

Conclusion: These failure rates are comparable to results in previous years. Failure rates in Connecticut's I/M program are in line with those reported in Test-Only programs[9]. Test-Only programs generally are considered by EPA to be the model for peak I/M performance. Based on failure rates, Connecticut's I/M program is operating at peak performance.

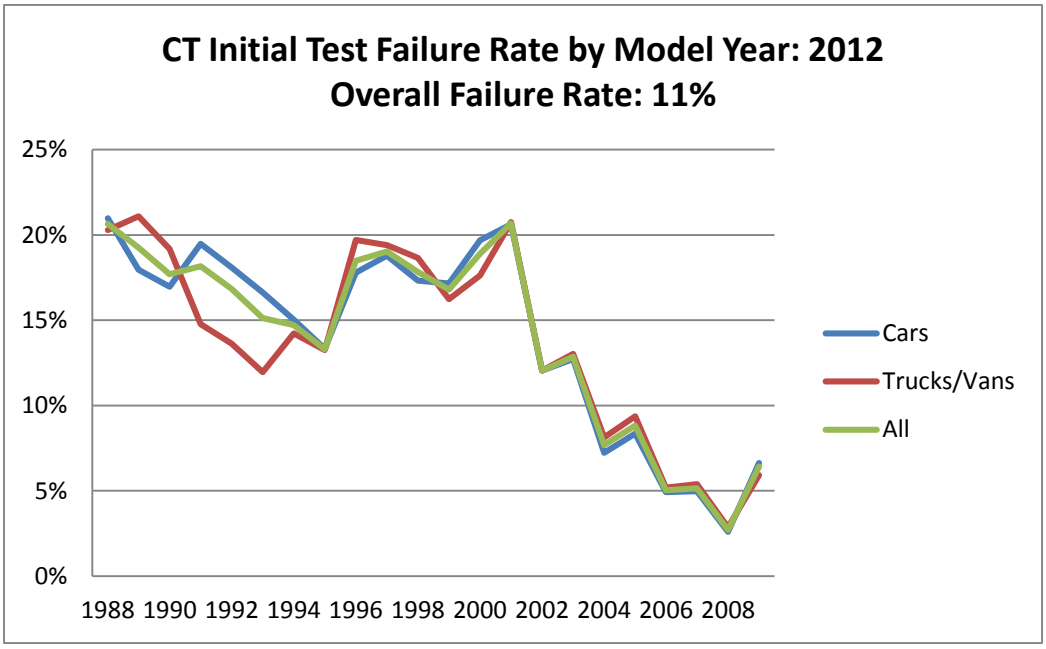
[9] At the end of this section is a chart that compares failure rates for the OBD test in Connecticut with failure rates in Delaware. Delaware is a well enforced Test-Only I/M program. Failure rates in both programs are nearly identical.



This chart shows the total number of inspections by vehicle model year, and vehicle type. The first four vehicle model years are exempted from testing, so the number drops sharply after the 2008 model year. All vehicles have a 10,000 lbs. or less GVWR.

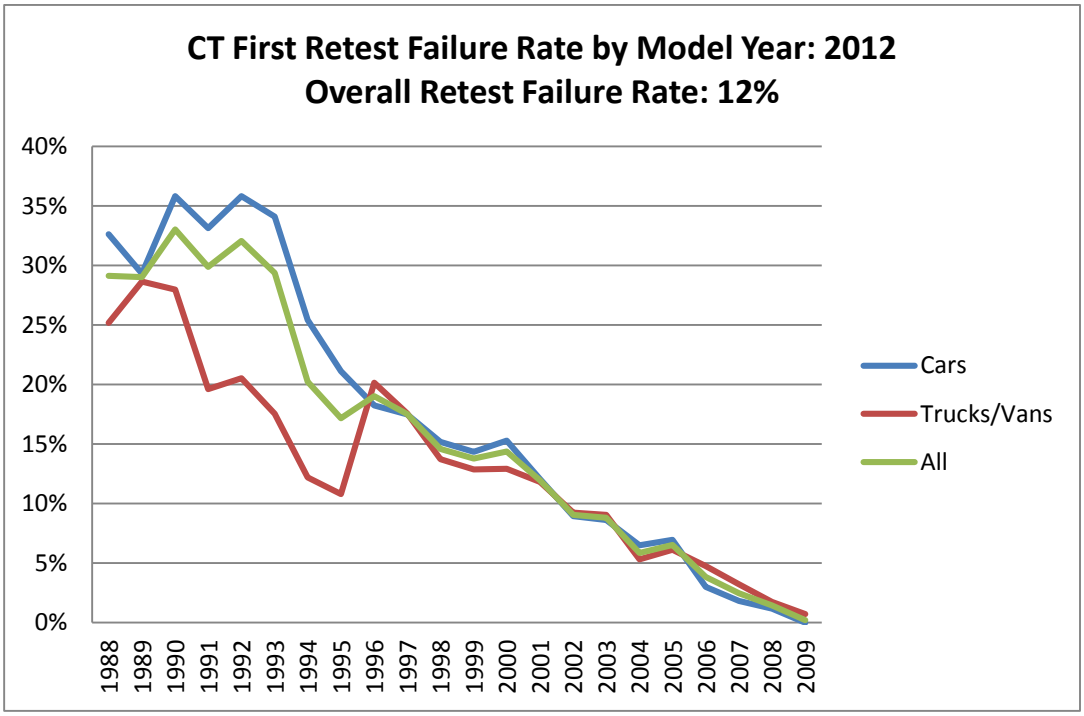


This chart shows the total number of inspections by vehicle model year and final inspection type. Most 1996+ vehicles received OBDII tests. A small percent (2%) of the vehicles newer than 1996 were models over 8500 lbs. GVWR without OBD systems.

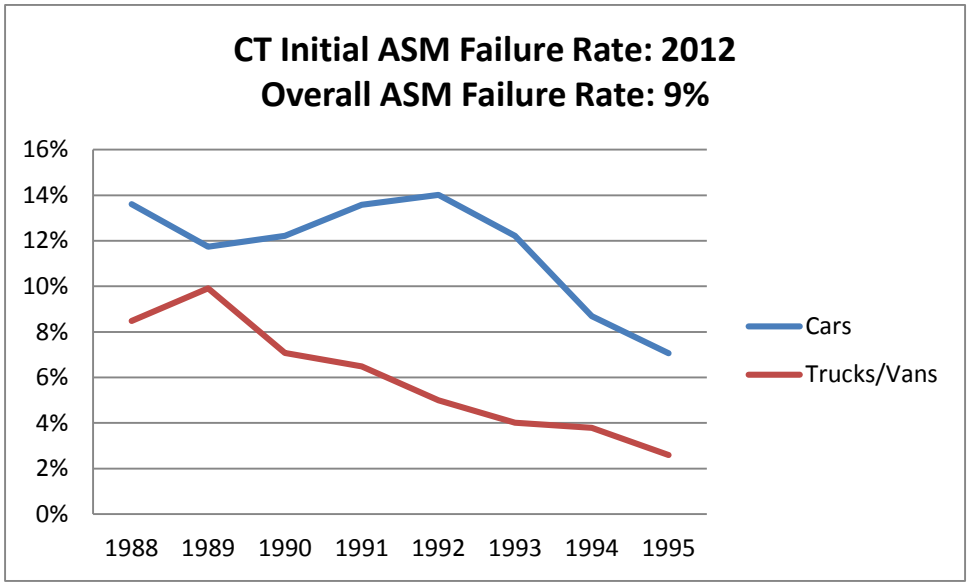


This chart shows the overall percentage of vehicles that failed the tailpipe test, gas cap test, visual emission control component test, or the OBD test. Some vehicles failed more than one inspection component. As expected, the failure rate is generally lowest for new vehicles. Following the pattern seen previously, the failure rate for cars and trucks spiked upwards for 1996 model year vehicles, due to increased stringency associated with the implementation of the OBDII test. Compliance with the OBDII test is considered to be more difficult than compliance with the ASM2525 or PCTSI test. The failure rate is consistent with failure rates reported in test-only programs in other jurisdictions. The high initial failure rate for 2009 model year vehicles is due to the fact that over half of these vehicles tested had dealer plates. Vehicles owned by dealers typically have high not ready rates because their batteries are often insufficiently charged, or had been disconnected during dealer prep[10].

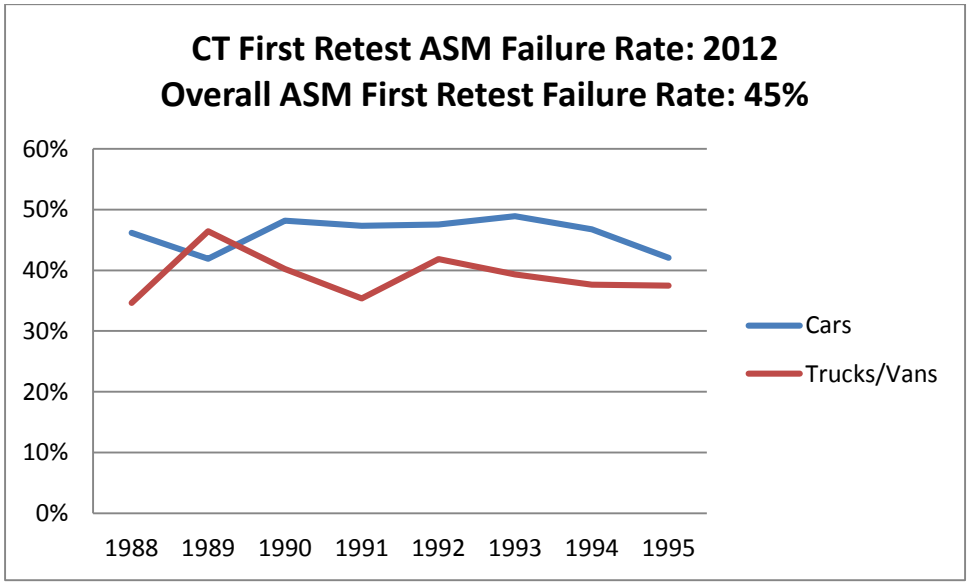
[10] Readiness status for all monitors usually sets to not ready when a vehicle's battery is disconnected.



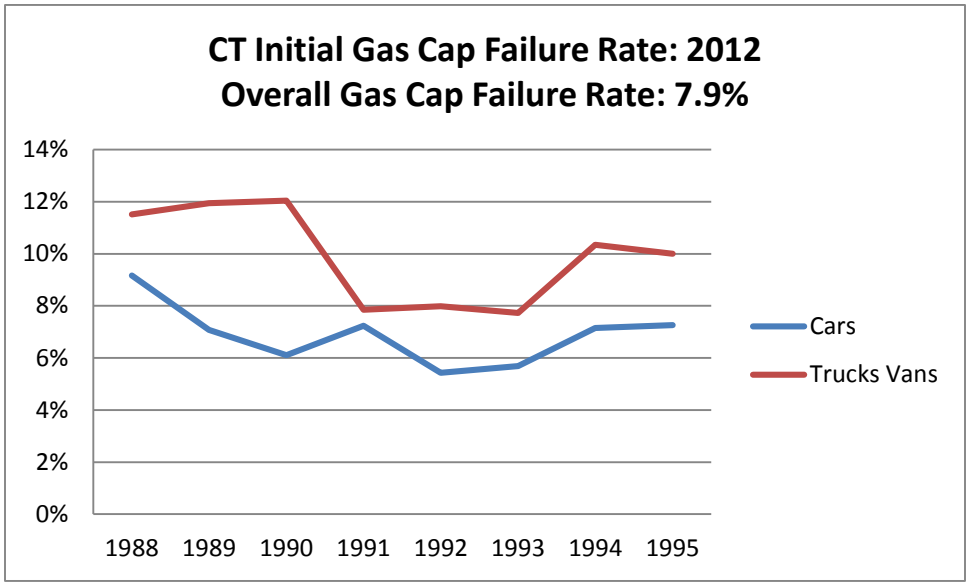
This chart shows the percent of vehicles by model year that failed their first retest. The failure rate is highest for the older model year vehicles, which is typical. Overall, 12% of the vehicles tested failed their first retest.



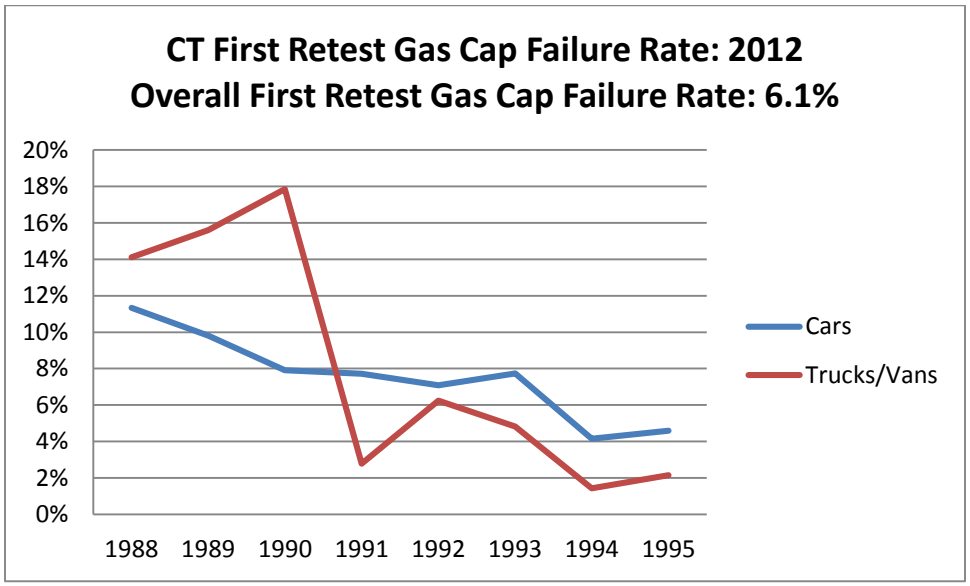
This chart shows failure rates by vehicle model year for the ASM test. The average ASM test failure rate for all vehicles was 9%. Typically, a higher failure rate for older model year vehicles is expected. 1996 and newer model year vehicles received ASM or PCTSI tests, only if they were not equipped with OBDII systems. As a result, there were not enough ASM tests on 1996 and newer vehicles to analyze trends.



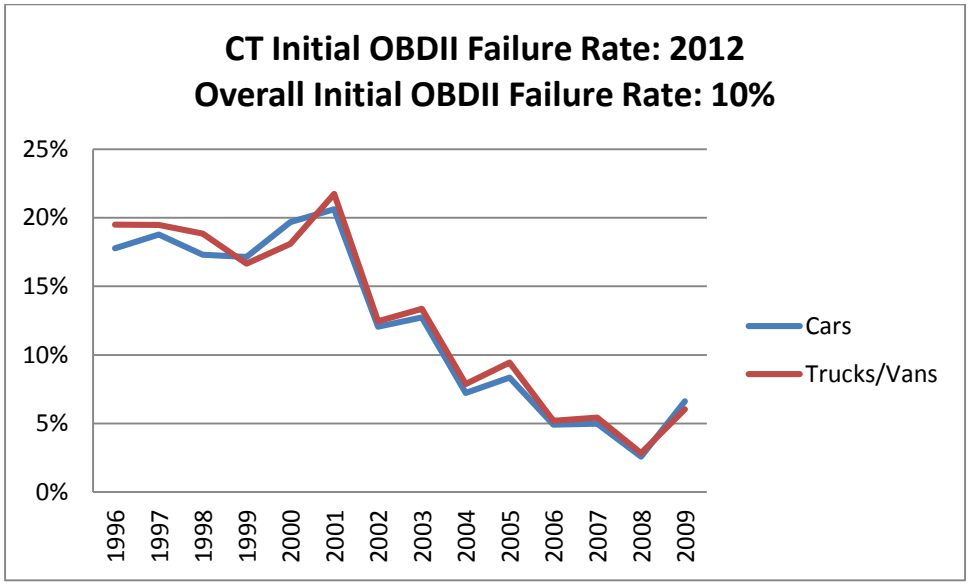
This chart shows the percentage of vehicles by vehicle model year that failed their first ASM retest. Overall, 45% of the vehicles failed the first ASM retest.



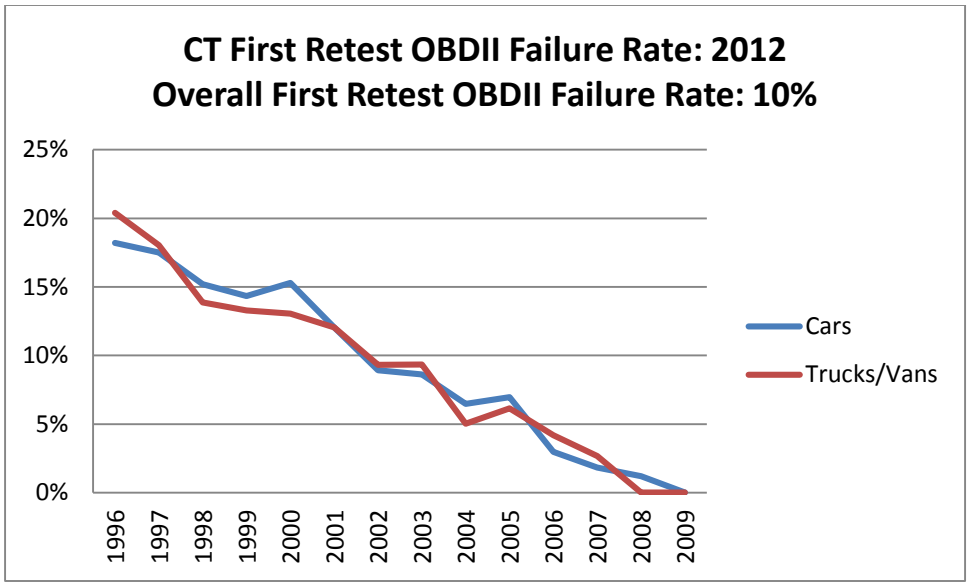
This chart shows the gas cap pressure test failure rate by vehicle model year. Overall, 7.9% of the vehicles that receive gas cap tests fail the test. 1996 and newer light-duty vehicles no longer receive gas cap tests.



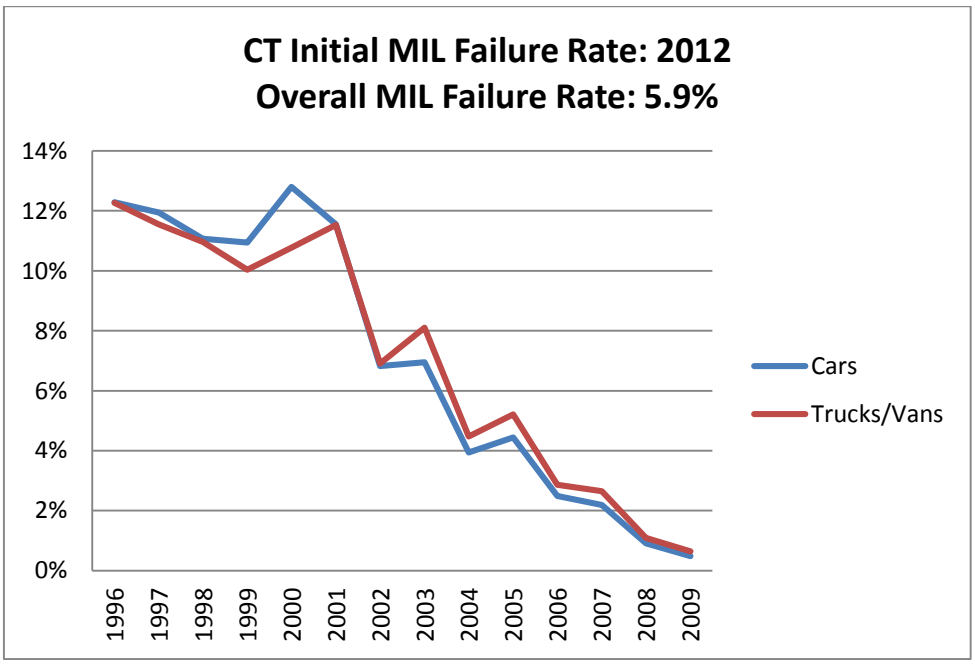
This chart shows the gas cap retest failure rate by vehicle model year. Overall, 6.1% of the vehicles fail the first gas cap retest.



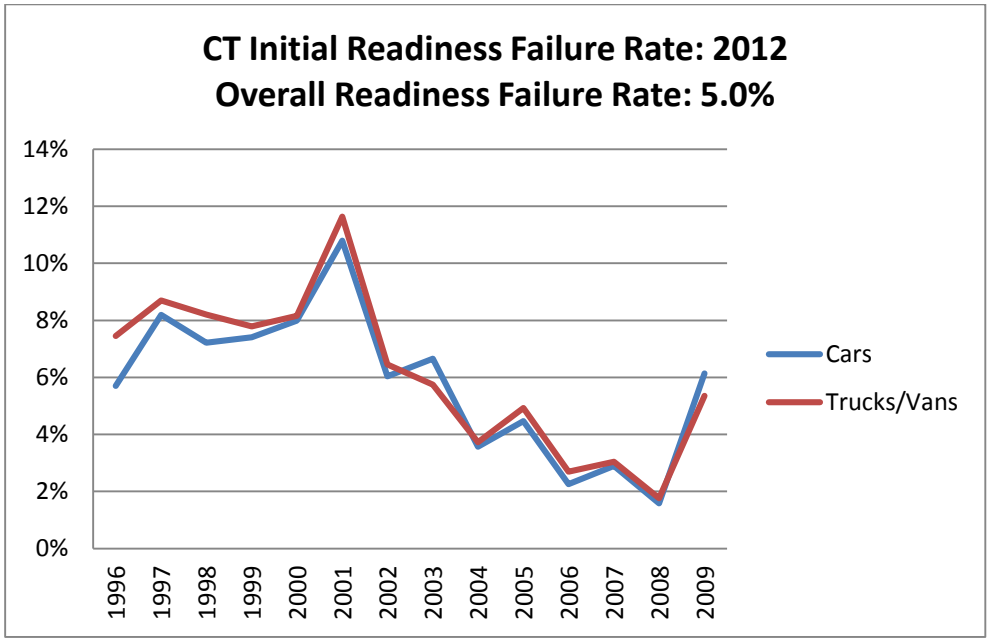
This chart shows failure rates by vehicle model year for the OBD test. The average OBD test failure rate for all vehicles was 10%. Typically, a higher failure rate for older model year vehicles is expected. 18% of the 1996 model year vehicles failed the test. EPA requires that the 2001 and newer model year vehicles have at most one monitor not ready as opposed to two for 2000 and older model year vehicles. This change in readiness requirement explains the slightly elevated failure rate for 2001 model year vehicles. The increase in failure rates for 2009 model year vehicles reflects a high "not-ready" rate for these models. The high initial failure rate for 2009 model year vehicles is due to the fact that over half of these vehicles had dealer plates. Vehicles owned by dealers typically have high not ready rates, because their batteries are often insufficiently charged, or had been disconnected during dealer prep.



This chart shows failure rates by vehicle model year for the first OBD retest. The average failure rate for all vehicles in the first OBD retest was 10%. Connecticut requires OBD failures to meet readiness requirements when retested. If a vehicle does not meet readiness requirements when retested, the inspection is aborted. Vehicles that are not ready on retest are not included in the above failed percentages.

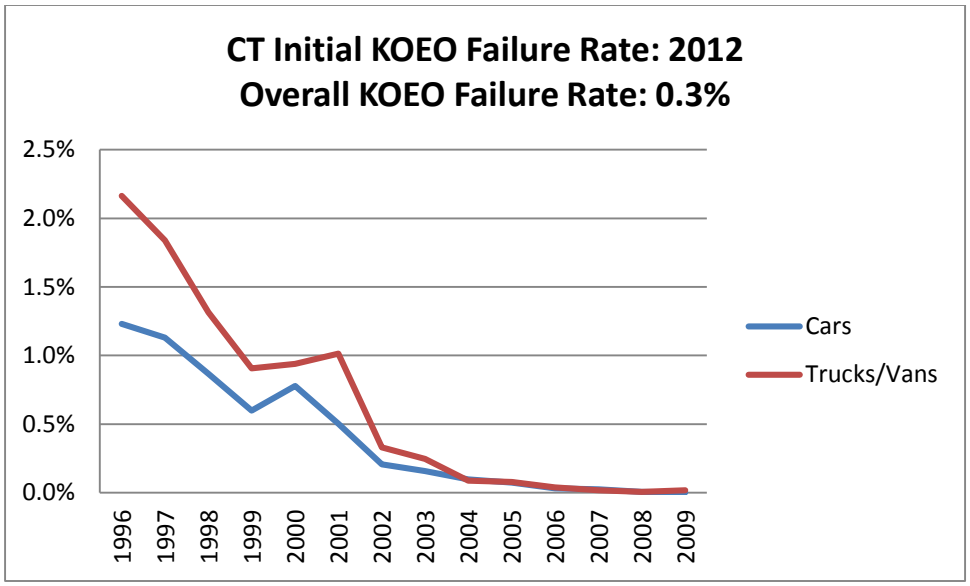


This chart shows the percentage of vehicles that fail the MIL Command check that's part of the OBD test. Most OBDII failures are for the MIL Command check. The average MIL failure rate for all vehicles was 5.9%. This graph shows that older model year vehicles have a higher failure rate, as expected.

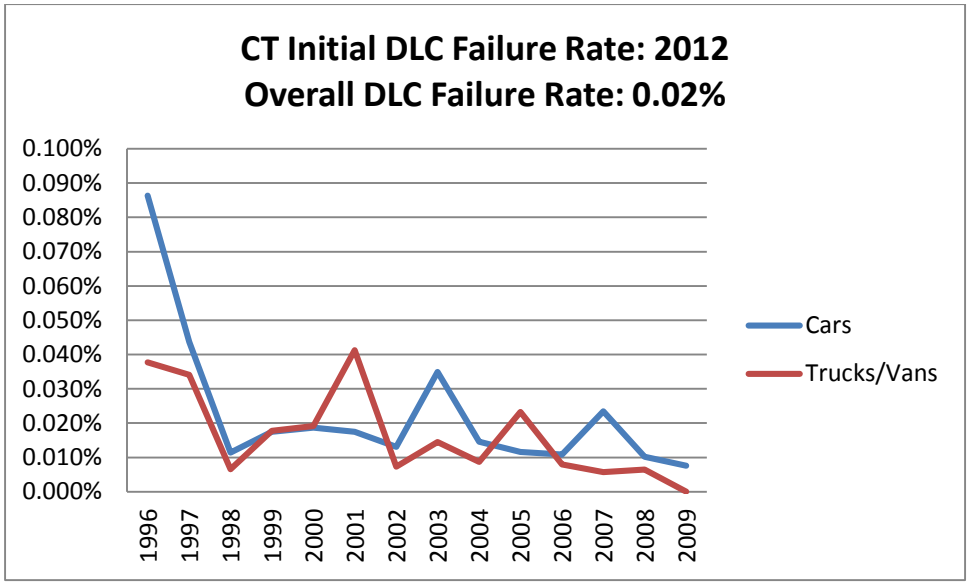


This chart shows the percentage of vehicles that exceed EPA's readiness criteria. OBDII systems must indicate whether or not the onboard diagnostic system has monitored each component. Components that have been diagnosed are termed "ready", meaning they were tested by the OBDII system. EPA requires that 2001 and newer model year vehicles have at most one monitor not ready as opposed to two for 2000 and older model year vehicles. This change in readiness requirement explains the elevated failure rate for 2001 model year vehicles. The high "not ready" rate for 2009 models is due to the fact that over half of the 2009 vehicles tested, had dealer plates. Vehicles owned by dealers typically have high not ready rates, because their batteries are often insufficiently charged, or had been disconnected during dealer prep[11]. Overall, 5% of the vehicles failed EPA's readiness criteria.

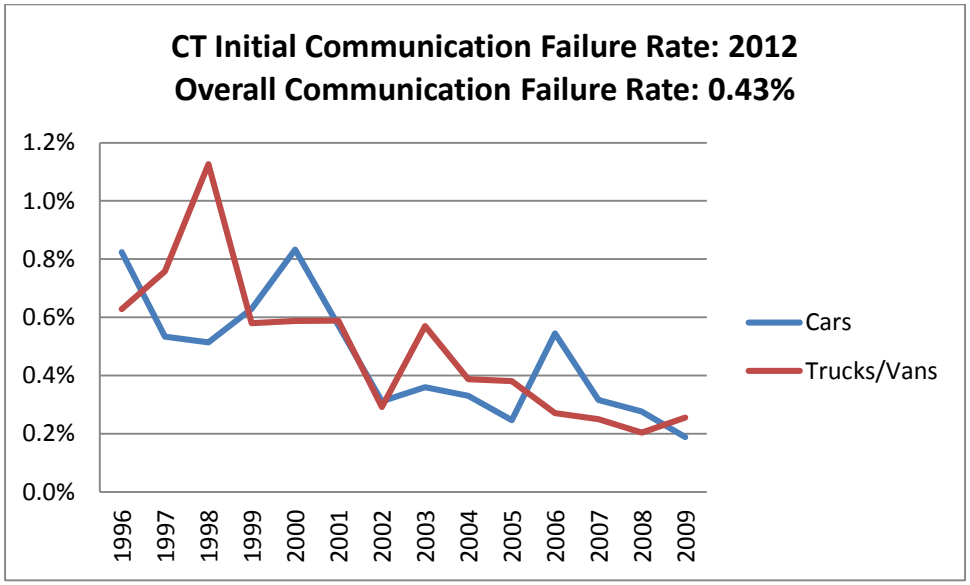
[11] Readiness status for all monitors usually sets to not ready when a vehicle's battery is disconnected.



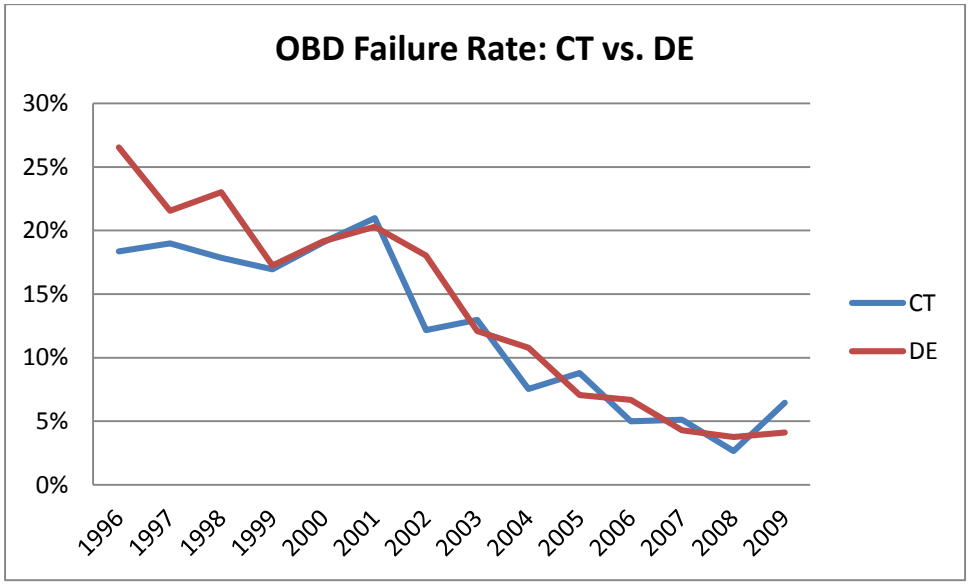
This chart shows failure rates by vehicle model year for the Key-On Engine-Off (KOEO) test, which is part of the OBD test. The KOEO determines if the MIL bulb is operational. The bulb should illuminate when the vehicle is turned on, but not started. The average KOEO failure rate for all vehicles was 0.3%.



This chart shows the percentage of vehicles that failed because the OBDII connector, termed the Data Link Connector or DLC, is missing, damaged or obstructed. Overall, few vehicles (0.02%) failed for this reason.



This chart shows the percentage of vehicles that failed to communicate with the OBDII test equipment. Overall, 0.43% of the vehicles failed for this reason.



This chart compares failure rates for the OBDII tests in Connecticut and Delaware. Delaware is a state-operated test-only program, which is considered by EPA to be a model for peak I/M performance. Failure rates in both programs are similar, which indicates that Connecticut is operating at peak performance with regard to failure rates.

3.0 Observed Failure Rates for Diesel-Powered Vehicles

Diesel-powered vehicles with a GVWR of 10,000 lbs. or less are also tested in the I/M program in Connecticut. Although the testing and reporting of diesel-powered vehicles is not required, historically Connecticut has reported on diesel testing. This report and Appendix B includes additional information on diesel initial testing, first retest as well as second and later retesting. If the vehicle is equipped with an OBDII system, an OBDII test is performed. Otherwise, the vehicle receives a test designed to identify excessive exhaust smoke opacity.

Failure rates for diesel-powered vehicles were calculated using test results from I/M test stations. Below is a brief description of the criteria used to determine if a vehicle passes or fails inspection.

Pass/Fail Criteria

Modified Snap Acceleration (MSA) Test: With this test, the throttle is "snapped" (i.e., accelerator is quickly pressed and then released) and exhaust smoke opacity is measured. This test is performed with the vehicle being in "neutral". The average of three snaps is calculated, and compared to the standard recommended by the federal government.

Loaded Mode Diesel (LMD) Test: Vehicles are tested using a dynamometer to simulate driving at 30 mph. Exhaust smoke opacity is measured.

OBDII Inspection: 1997 and newer model year diesels vehicles with less than 8500 lbs. GVWR get an OBDII inspection. The emissions test system is plugged into the OBDII connector and information on the status of the vehicle's OBD system is downloaded. Diesel-powered vehicles will fail the OBDII inspection if they have any of the following problems:

- Malfunction Indicator Lamp (MIL) is commanded-on;
- MIL not working (Termed Key-On Engine-Off, KOEO, failure);
- OBD diagnostic link connector damaged.

Summary of Failure Rates for Diesel-Powered Vehicles

Following is a summary of test results for the January 1, 2012 to December 31, 2012 period. In 2012, 10,200 diesel-powered vehicles received opacity tests, and an additional 2,501 vehicles received OBD tests.

Test Type	Parameter	2012 Result
OBD	% Fail Initial	8.4%
	% Fail First Retest	6.8%
MSA	% Fail Initial	3.2%
	% Fail First Retest	27%
LMD	% Fail Initial	0.8%
	% Fail First Retest	6.1%

Appendix B has details on the OBD, MSA, and LMD test results for diesel and gasoline powered vehicles.

Conclusion: These failure rates are similar to rates found in previous evaluation reports. Outside of Connecticut, few states perform periodic tests on diesel-powered vehicles, so there is little basis for a comparison of Connecticut's diesel-powered vehicle failure rate with other states.

4.0 Enforcement of Connecticut's I/M Program

Connecticut's program uses both registration denial and late fee assessment to assure compliance. This section presents an analysis of data relevant to the enforcement of Connecticut's I/M program. Statistics required by 40 CFR 51.366 are presented below, and in the Appendix B, with exception of 40 CFR 51.366(d)(1)(iv) and (v) which are not applicable to Connecticut's program.

Overall Compliance Rate

The overall compliance rate is based on the number of passing inspections divided by the number of vehicles subject to inspection. Connecticut committed to a 96% compliance rate for the vehicles subject to I/M requirements in the SIP. In 2012, 974,518 registration renewals were audited, resulting in 48,759 denials, of which 91.6% later complied. This works out to a 99.6% compliance rate, so the overall compliance rate exceeds the SIP compliance rate.

Late Fees: In 2012, 162,665 late fees were assessed for total fines to motorists of $3.2 million. These fines serve as an effective motivation for compliance with inspection requirements.

Preventing Circumvention of Connecticut's I/M Requirement

EPA requires states to prevent motorists from avoiding I/M requirements by falsely registering vehicles out of the program area, or falsely changing fuel type or weight class on the vehicle registration. EPA also requires states to report on results of special studies to investigate the frequency of such activity.

- **Circumventing I/M Tests in Connecticut –** Circumventing I/M tests in Connecticut is nearly impossible. First, Connecticut implements the I/M program on a statewide basis. Second, Connecticut tests all fuel types, including hybrids, so motorists cannot avoid inspection by changing fuel type. It may be possible to avoid inspection by registering the vehicle with a GVWR greater than 10,000 lbs., but likely is limited in scope due to the added expense. The majority of vehicles registered with an incorrect GVWR are those where the vehicle owner registers the vehicle at a lower weight to avoid the added expense and would not be emission eligible (>10,000 lbs.) with their corrected weight.
- **Detection and Enforcement Against Motorists That Falsely Change Vehicle Classifications To Circumvent Program Requirements –** Historically, 99% of emission eligible vehicles in Connecticut are in the Passenger, Commercial or Combination classifications. Incidents of motorists modifying a vehicle's registration classification to a non-emission eligible class are rare, most likely because of the added expense, documentation and inspection requirements.
- **Vehicles registered in Connecticut that are operated out-of-state – Connecticut -** DMV has recently changed its policies with respect to detecting vehicles that are registered in the State of Connecticut, but are being operated

outside of the state, to avoid being emission tested. Specifically, under its current procedures, DMV will not allow a vehicle owner to receive numerous time extensions. These efforts are definitely helping to make vehicles registered in Connecticut emissions compliant.

Percent of Failed Vehicles That Ultimately Pass

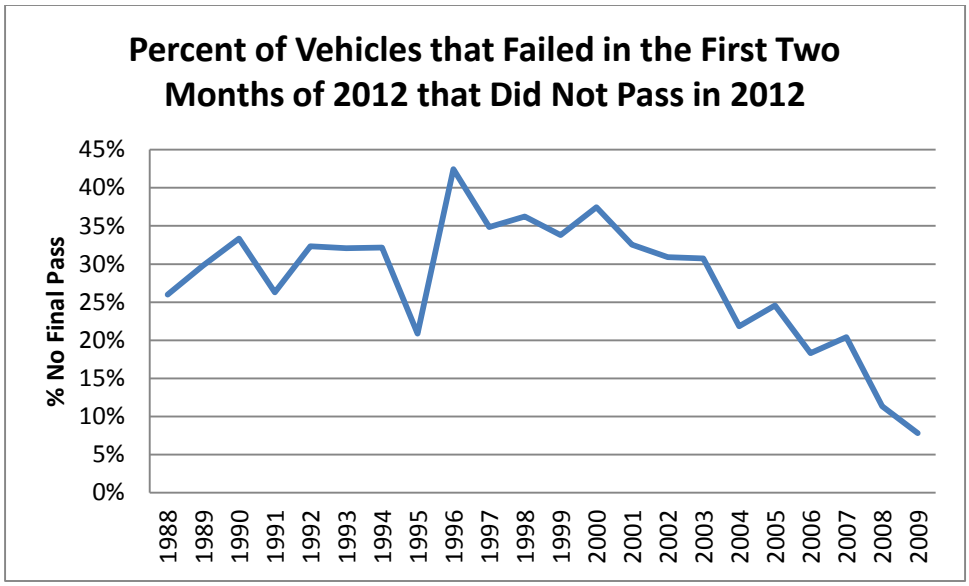
To estimate whether *vehicles that failed their emissions test ultim*ately pass, the fate of vehicles failing the I/M test in 2012 was evaluated. As Connecticut has done in previous reports per EPA recommendations, these results are calculated as the percentage of vehicles with no known final outcome as compared to vehicles that initially failed and do not receive a final pass.

Failures for the first two months of 2012 were tracked through 12/31/2012. Results are shown in the table and figure below. 30% of the failures during this two month period had not yet received a passing result or waiver. Ultimately, all vehicles must comply, or they cannot be registered in Connecticut, since I/M compliance is a prerequisite for vehicle registration. As noted above, Connecticut levied $3.2 million in fines for late registration. Overall, over 99% of the vehicles that were tested complied with I/M program requirements.

EPA's comments on the 2010-2011 Biennial Evaluation Report encourages states to improve the program performance by reducing the number of vehicles with no final outcome. This year's evaluation demonstrates that only 19.4% of the failed vehicles had not successfully passed emissions testing by the end of 2012, which is an improvement over the 2011 results. To avoid vehicles that fail in a state with a strong enforcement program, such as Connecticut's, from subsequent re-registration, perhaps in a different state/area with more relaxed testing requirements, EPA suggests that state/areas with I/M programs consider developing Vehicle Identification Number (VIN)-based databases for vehicles that fail I/M tests and do not receive final passing results. Connecticut looks forward to EPA's leadership in developing partnerships with the other jurisdictions to improve the program by addressing the number of vehicles with no final outcome.

Vehicles Tested from 1/1/12 to 3/1/12
with No Known Outcome

Model Year	Initial Fail	Final Retest Pass	No Final Pass	% No Final Pass
1988	127	94	33	26%
1989	171	120	51	30%
1990	159	106	53	33%
1991	194	143	51	26%
1992	232	157	75	32%
1993	321	218	103	32%
1994	370	251	119	32%
1995	608	481	127	21%
1996	775	446	329	42%
1997	1,475	961	514	35%
1998	1,396	890	506	36%
1999	1,648	1,091	557	34%
2000	1,580	988	592	37%
2001	1,847	1,246	601	33%
2002	1,437	993	444	31%
2003	1,246	863	383	31%
2004	1,575	1,231	344	22%
2005	818	617	201	25%
2006	1,026	838	188	18%
2007	466	371	95	20%
2008	574	509	65	11%
2009	282	260	22	8%
TOTAL	**18,327**	**12,874**	**5,453**	**30%**



This chart shows the percentage of vehicles that failed the emission test in the first two months of 2012 that did not have a passing result in 2012. The increase from the 1995 to 1996 model year indicates that compliance with the OBD test may be more difficult than the tailpipe test used for pre-1996 vehicles. Ultimately, all of these vehicles must pass if they are registered in Connecticut.

Waivers Issued

Another aspect related to enforcement is the number of waivers issued. Program effectiveness is inversely proportional to the waiver rate. As the following table shows, less than 0.3% of the vehicles that failed received waivers, indicating that the program is effective. This is much lower than the waiver rate committed to in the SIP and also much lower than the rates in many other states' I/M programs. Connecticut's I/M SIP committed to a waiver rate of 1%.

Conclusion: Connecticut exceeds SIP requirements for enforcement of motorist compliance. The overall compliance rate in Connecticut exceeds 96%, which is the compliance rate of Connecticut's SIP. Connecticut actively investigates non-compliance and assesses a large number of fines for vehicles that are not presented for emission inspection in a timely manner. Connecticut issues fewer waivers than committed to in Connecticut's SIP.

% of Failed Vehicles Receiving Waivers[12] in 2012

Model Year	Passenger Car (P)	Truck (T)	Total # of Waivers	# of Failed Vehicles	% of Failed Vehicles Receiving Waivers
1988	4	0	4	724	0.55%
1989	0	1	1	897	0.11%
1990	2	1	3	861	0.35%
1991	4	0	4	1,012	0.40%
1992	4	0	4	1,284	0.31%
1993	1	0	1	1,652	0.06%
1994	1	1	2	2,297	0.09%
1995	4	0	4	2,860	0.14%
1996	10	4	14	4,373	0.32%
1997	10	7	17	6,362	0.27%
1998	19	8	27	7,595	0.36%
1999	18	4	22	7,879	0.28%
2000	20	6	26	8,263	0.31%
2001	24	19	43	9,780	0.44%
2002	15	13	28	12,762	0.22%
2003	6	12	18	6,587	0.27%
2004	18	9	27	9,509	0.28%
2005	4	7	11	4,324	0.25%
2006	2	0	2	6,040	0.03%
2007	0	1	1	2,292	0.04%
2008	0	2	2	3224	0.06%
2009	0	0	0	1241	0.00%
Total	166	95	261	101,818	0.26%

[12] Diagnostic and Cost waivers combined.

Enforcement of Proper Test Procedures Through Trigger Reports and Video Audits

Connecticut is a model for other states in how to enforce proper I/M test procedures. Connecticut actively looks for cases where inspectors may be performing improper inspections, passing vehicles that otherwise should fail. The following is a summary of how Connecticut ensures that stations perform proper inspections:

- DMV and its contractor, Applus, run extensive trigger reports to assure that inspection stations follow proper test procedures. The following demonstrates that DMV has developed a comprehensive set of triggers to verify and enforce compliance with proper test procedures:
    - Trigger reports look for anomalies in data recorded during inspection. These reports help DMV identify stations performing fraudulent or inaccurate inspections;
    - Triggers focus on finding the following types of fraud;
        - Clean Scanning: Performing an OBDII test on a fault-free vehicle instead of the vehicle that should be tested;
        - Clean Piping: Performing a tailpipe test on a passing vehicle instead of the vehicle that should be tested;
    - These reports are generated frequently to identify stations performing improper inspections. Connecticut promptly investigates all significant cases of possible inspection fraud.
- In addition to the auditing conducted by DMV, DMV requires its Contractor to maintain quality assurance measures, which they meet by conducting additional audits.
- On a monthly basis, DMV rotates staff, so that there are two full time video auditors who continually monitor inspections during station operating hours via digital web cameras. Video audits have the following features:
    - Real time monitoring/control of vehicle inspections;
    - Video auditors can selectively view inspections; and
    - If anomalies are detected, DMV requires its contractors to take affirmative actions to halt the inspection.
- No other state does more thorough trigger or video audits and follow-up actions.

Triggers for Clean Scanning/Clean Piping

DMV runs several trigger reports to identify clean scanning and clean piping:

- **Mismatch between entered Vehicle Identification Number (VIN) and OBDII VIN** – Certified Testing Inspectors (CTI) may attempt to pass vehicles with OBDII faults by scanning a problem-free vehicle instead of the one that should be inspected.
    - If the vehicle has an electronic VIN available through the vehicle's OBDII system, clean scanning cases can be identified by comparing entered VIN with VIN provided by vehicle's OBDII system.
    - DMV investigates all VIN mismatches. Most mismatches correspond to vehicles owned by the same person or vehicles that had Program Control Modules replaced without proper programming of the vehicle's computer with the correct VIN, also termed reflashing.
- **Questionable Retests** – Mismatches between initial tests and retests could indicate that the inspector clean-scanned vehicles on retests. DMV checks the following parameters:
    - Supported readiness monitors – different vehicles have different monitors;
    - OBD computer identifiers;
- **Short Time Between Initial OBD Test Fail And Retest Pass** – Stations that often show short time periods, in particular one-half hour, between the initial test failure and retest pass could be performing fraudulent inspections. (Short Time Period = ½ hour)
    - It is difficult to repair OBD failures and get failing vehicles to pass within a short time period:
        - MIL-On Fails – It takes time for the MIL to go off, or readiness monitors to reset if codes are cleared.
        - Readiness Fails – It takes time for readiness monitors to set to ready, especially the evaporative monitor.
- **Large Emission Reductions in a Short Time Period (1981-1995 Vehicles)** – Stations reporting large emission reductions in a short time period are more likely to be clean piping the retests. (Short Time Period= ½ hour)

Based on an independent review of trigger data, dKC found that less than 0.2% of the inspections were suspect. This indicates that inspection fraud is not a serious problem in Connecticut.

Conclusion: Evaluation of the data demonstrates that Connecticut vigorously enforces proper inspection procedures. Inspection fraud is not a problem in Connecticut's I/M program. Connecticut actively investigates possible cases of inspection fraud and initiates corrective action. Less than 0.2% of the tests in Connecticut are suspect.

5.0 Quality Assurance Audits

The DMV and their contractor, Applus, perform the quality assurance (QA) audits required by EPA. Following is an overview of Connecticut's audits, and other QA activities conducted by DMV.

Overt Audits

EPA requires that Overt Audits be performed twice per year per station. DMV meets these requirements through use of the Emission Test Monitoring Report (ETMR). Connecticut prepares ETMRs more frequently than required by EPA. Each month, at least one ETMR is performed on each station. In addition, Applus also performs overt audits. Connecticut also checks more items than required by EPA. Connecticut is continuing to evaluate the auditing process to build upon the program's success.

Stations	**2012**
Total Overt Audits Performed	3,393
No. of Stations Audited	228
No. of Times Each Station Was Audited (range)	1-30[13]
No. of Stations That Had No Violations for the Entire Year	71
Total Number of Audits for Which One or More Violations Were Reported	391
No. of Stations That Had Violations	157
No. of Stations That Had 1-3 Violations	121
No. of Stations That Had 4-6 Violations	30
No. of Stations That Had 7-12 Violations	6

Agents	**2012**
No. of Agents That Performed Audits During the Course of the Year	9
No. of Agents That Are No Longer Performing Overt Audits	1
No. of Agents That Are Currently Assigned to Perform Audits	8
No. of Audits per Agent (range)	0[14]- 783
No. of Station Violations Reported per Agent (range)	1 - 143

13 All stations except two were visited at least twice. One station was not visited twice, as it joined the program during the second half of the year, and DMV performed one QA audit at this station. As for the other station, it was not audited because DMV inadvertently missed it due to a paperwork error.

14 One agent out on Workman's Comp for the entire year did not perform any audits.

Equipment Audits

EPA requires that equipment audits be performed twice per year per station. DMV meets these requirements through the QA audits. Connecticut conducts equipment audits more frequently than required by EPA. High volume stations are checked monthly, while low volume stations are checked twice per year. In addition, Applus also performs equipment audits. Connecticut checks more equipment items than required by EPA. While an audit may require a station to discontinue tailpipe testing, it can continue OBD testing. Therefore, no stations were totally shut down due to a failed gas equipment audit. Results are presented below. In 2011, 67% of the stations failed equipment (gas) audits, while in 2012 this percentage dropped to 36%. The drop was due to the roll out of new, more reliable emission test benches in the new program.

Results of Equipment Audits

Parameter	2012
Total Equipment Audits	717
Total Stations that Failed Equipment Audit	219
Percentage of stations that failed an equipment (gas) audit	35.92%
Number of stations totally shut down as a result of a failed equipment (gas) audit [15]	0
Percentage of stations shut down as a result of failed equipment (gas) audit	0.00%

15 Stations that fail equipment audit are prohibited from performing tailpipe emission testing until the equipment problem was resolved. Stations were allowed to continue to perform OBD testing.

Covert Audits

EPA requires that covert audits be performed at least once per year per station. DMV meets these requirements by performing covert audits and video surveillance audits. During 2012, DMV performed 64 covert audits. However, DMV performed 438 video surveillance audits, which repeatedly have been proven to be more effective than covert audits in detecting fraud.

The limited numbers of covert audits in 2012 were due to several factors:

- DMV did not get vehicles to perform covert audits until approximately May of 2012.
- DMV did not have enough available staff that was unknown to the CTIs, until they hired new employees in August and October of 2012.
- Some of the covert audit vehicles were identified by CTIs or they had mechanical problems.

DMV is on track to perform at least one covert audit per station in 2013.

Warnings are routinely issued for false passes if DMV does not find that the CTI intentionally or negligently falsely passed a vehicle, thus there can be a difference between the number of false passes and suspensions. Suspensions are usually associated with violations found from trigger reports and data audits. Most false passes are for minor procedural errors, such as failing to perform the visual MIL check correctly. Unless the station repeats these errors, they are issued warnings rather than being suspended.

As stated in the Applus contract, and in the Applus Station Agreement, a CTI is suspended (pending an investigation) when it is determined that the false pass was the result of "Intentionally improperly passing a failing vehicle." Most errors identified by covert and video surveillance audits were determined to be unintentional and due to poor attention to detail. However, a second occurrence of making a careless error, such as missing or incorrectly answering the MIL question, results in an automatic suspension.

Connecticut is a model for running trigger reports and following-up on the issues identified as a result of those audits. Suspensions for violations other than covert audit findings or triggers were for various reasons as outlined in the contract under "Inspector Violations," including, but not limited to data entry errors or incorrect test procedures. The statutory and regulatory basis of the program does not allow Connecticut to issue fines or hold hearings concerning inspectors that falsely pass vehicles in covert audits. Instead, these inspectors are suspended from testing. Whether or not to suspend a station depends on the assessment of the severity of the infraction by Applus.

Contractor QA Activities

Fraud Prevention Systems

In addition to Connecticut's efforts to eliminate fraudulent and inaccurate tests, the State's contractor, Applus, has implemented systems to prevent fraud, including the Connecticut Decentralized Analyzer System (CDAS), provided by Applus, which has features to assure that accurate emissions tests are performed. These systems and features are described below:

- Secure iris recognition system – use of biometrics
- Trend analysis monitoring –
    - Test time duration
    - Initial and retest pass/fail rate
    - Repair costs
    - Waivers
    - Speed variability check
    - Gas cap failure analysis
    - After hours inspection analysis
    - Aborted inspection analysis

Analyzer QA Functions

- Sample system leak check
- Analyzer gas calibrations – Every 72 hours or system will lock out testing
- CDAS units require a two point calibration with BAR 97 high gas followed by BAR 97 low gas blend
- CDAS units have passed BAR 97 certification tests
- Dynamometer undergo a coast down every 72 hours
- Raw transport time verification
- Various other hardware checks are done every 72 hours
- Low sample flow, sample dilution checks etc.

Contractor QA Activities (cont.)

Inspection Results Analysis Audits – monitoring of performance indicators

- # of offline inspections
- Gas cap failures
- OBD failures
- After hours testing

Digital Audits – monitoring of equipment service and repair

- Leak check failures
- NO cell age
- Gas cap calibration failure
- NO response time
- CO response time
- O2 response time
- NO low calibration gas drift
- Bench low calibration failure rate
- Parasitic loss changes

Conclusion: While Connecticut did not meet the required number of covert audits in this inspection cycle due to extenuating circumstances, Connecticut's actions nonetheless demonstrate substantial compliance with EPA's recommended levels of quality assurance.

6.0 Analysis of Data from Remote Sensing Devices (RSD)

The remote sensing data analysis indicates that vehicles that fail inspection, including the OBDII inspection, have much higher emissions than those that pass. While the sample is too small to make an accurate calculation of emission reductions, Connecticut's I/M program appears to be getting the benefits predicted by EPA's mobile emissions model, MOVES. The small sample limits the accuracy of the estimated emission reductions and can only be used as a rough assessment of the program.

Background

EPA requires independent on-road emissions testing on 0.5% of the tested vehicle population once every inspection cycle, pursuant to 40 CFR 51.371(a) (3). Since Connecticut's inspection cycle spans two years, Connecticut is in full compliance with this requirement by testing once every two years. Connecticut requires Applus to measure vehicle emissions with remote sensing devices (RSD). RSD allows Connecticut to meet EPA's requirements without inconveniencing motorists. RSD also allows an independent assessment of the effectiveness of Connecticut's I/M program.

RSD measures emissions by passing a light source across a highway to a source detector. The source detector measures absolute concentrations of hydrocarbons[16] (HC), carbon monoxide (CO), nitric oxide[17] (NO), and carbon dioxide (CO_2) in the diluted exhaust. From these measurements, exhaust concentrations of HC, CO, and NO in the undiluted exhaust are calculated.

In September 2012, Applus contracted with ESP[18] to conduct approximately 21,000 tests using RSD. After removing invalid records and matching results with the vehicle I/M database, 9,255 records remained (~1% of the vehicles tested in the I/M program annually). The primary reason for the lower number of records in the matched dataset is that the four newest model years are not in the I/M database, since they are exempt from testing. The RSD program meets EPA's on-road test requirements.

Summary of Observed Remote Sensing Device (RSD) Emission Levels

- As expected, average RSD emissions and the percentages of high emitters are lowest for the newest vehicles.
- In the September 2012 tests, 13 vehicles or 0.08% of the sample exceeded the 6% RSD CO limit. This criterion is used in some programs to identify gross emitting vehicles. In 2009, when the last survey was done, about the same percentage of the sample (0.09%) exceeded this

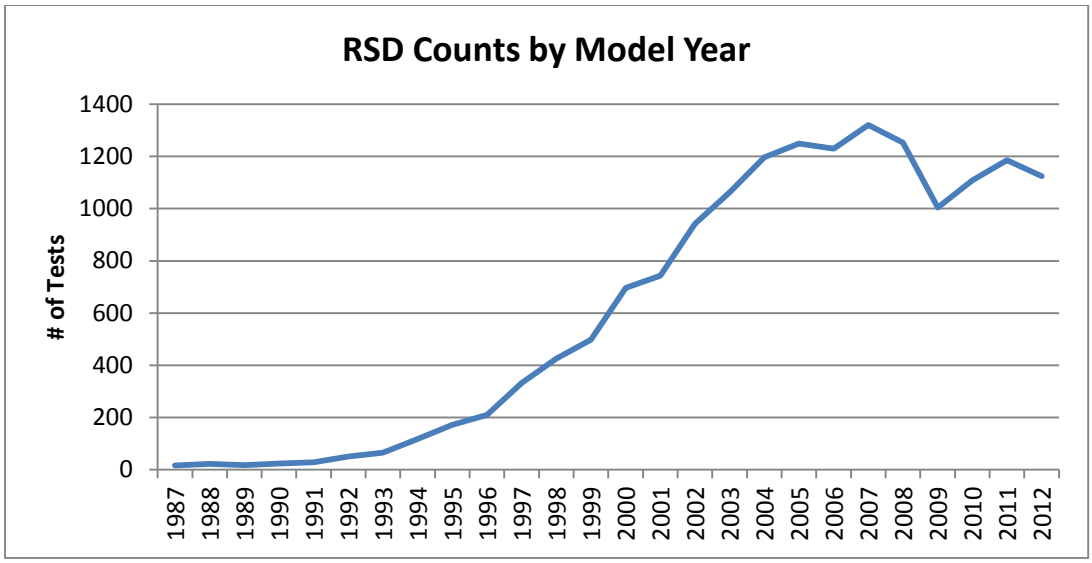
16 Hexane is used as a surrogate for HC.

17 NO is used as a surrogate for oxides of nitrogen (NOx).

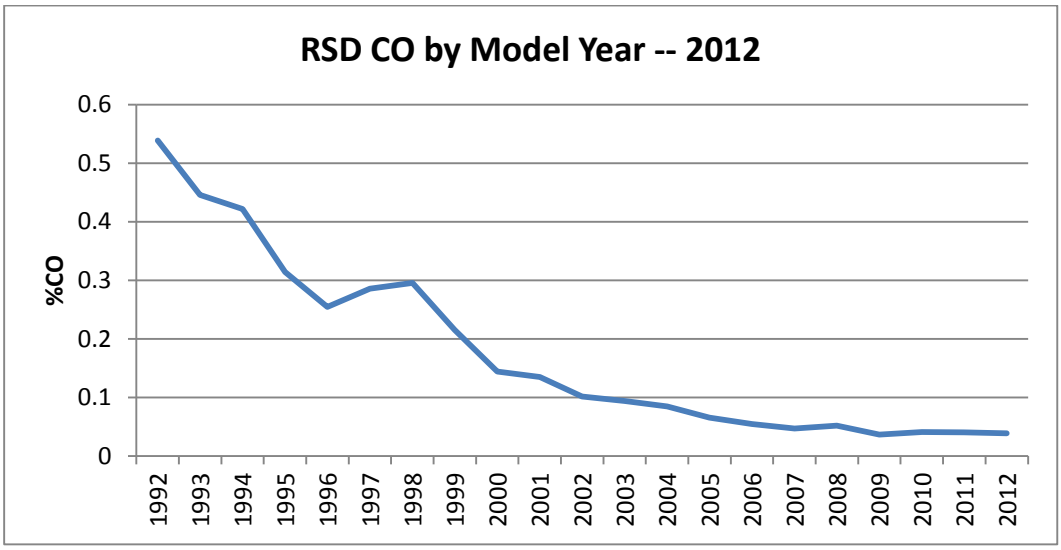
18 ESP is the only provider of Remote Sensing services.

limit. In 2007, 0.21% of the vehicles tested exceeded the 6% RSD CO limit. There are virtually no gross polluting vehicles in the fleet, because of vehicle turnover (replacing older high emitting vehicles with new low polluting vehicles) and the continued effectiveness of Connecticut's I/M program.

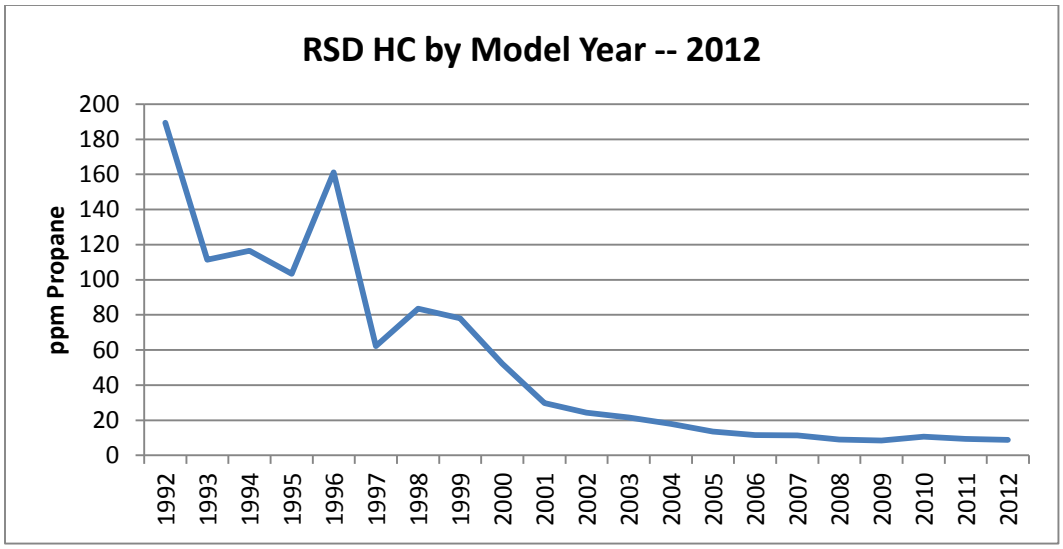
- Emission trends can be observed before and after the emissions inspection. Of particular interest are RSD emissions for vehicles that were scanned via RSD prior to failing I/M tests.
- Average RSD emission levels for vehicles that failed I/M tests were much greater than average RSD emission levels for vehicles that had passed.
    - In particular, OBDII failures had much higher emissions than vehicles that passed their OBDII inspection.
    - OBDII tests identify vehicles with high emissions even though they do not directly measure emissions.
- Connecticut exempts the newest four model years from I/M testing. Remote sensing demonstrates these vehicles have very low emissions. Continuing to exempt these newest four model years from I/M requirements does not significantly impact air quality**.**
- Remote sensing data collected in Connecticut demonstrate that older vehicles without OBDII systems will contribute significant amounts of pollution now and in the future. Therefore, even though some states are dropping tailpipe tests, continuing tailpipe tests on pre-1996 vehicles in Connecticut's I/M program maintains the air quality benefits necessary due to Clean Air Act requirements and statutory restrictions.



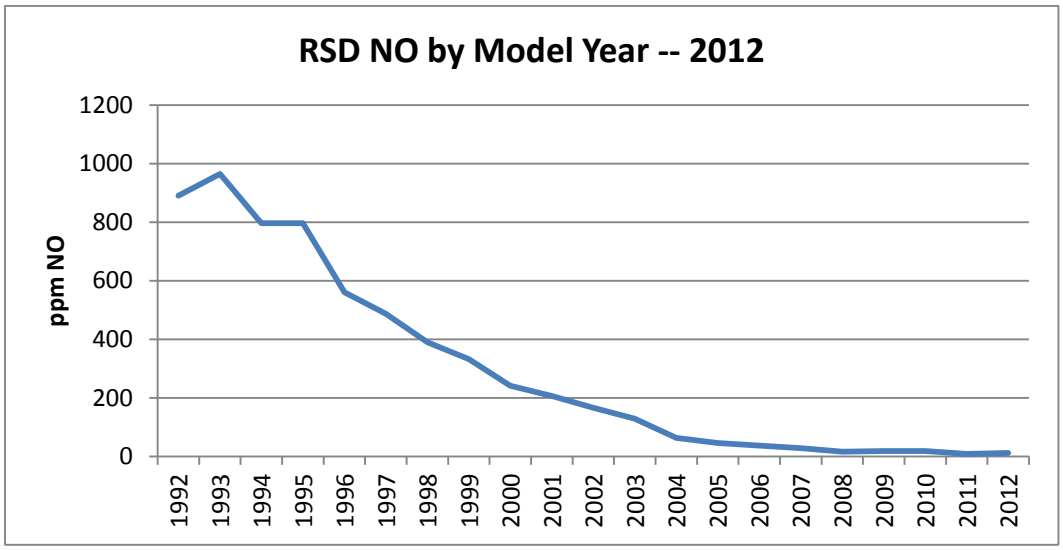
This chart shows the number of vehicles scanned by RSD by model year. There are fewer older models in the fleet and they are driven less so there are fewer observations of them.



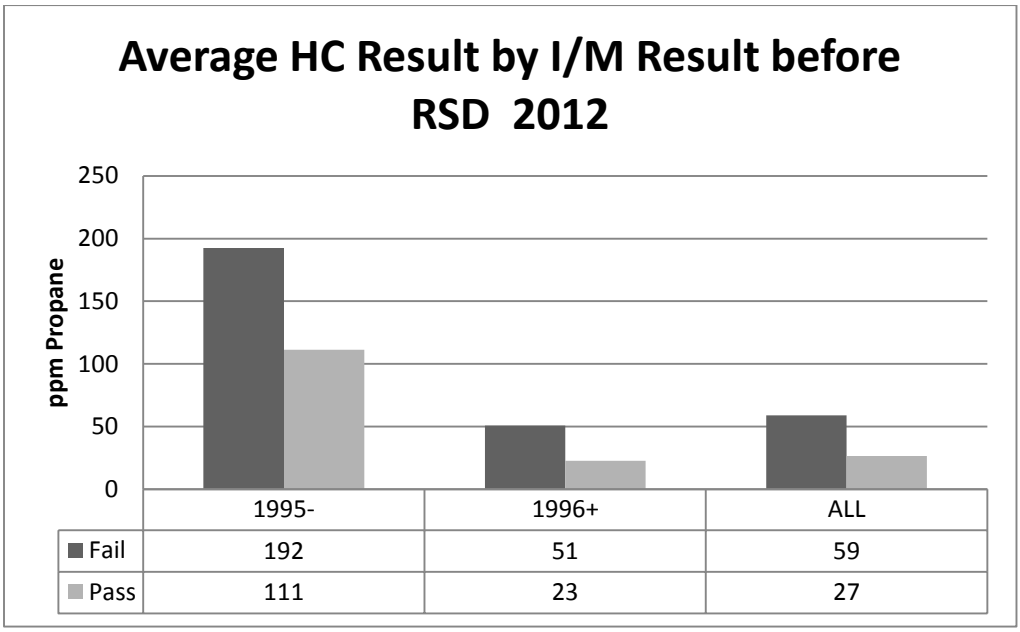
This figure shows average carbon monoxide (CO) RSD readings by model year. Increasingly, more stringent EPA emission standards for newer vehicles and expected deterioration of emission controls in older vehicles result in newer vehicles having much lower emissions. The low sample sizes for the older vehicles causes considerable variation in average readings.



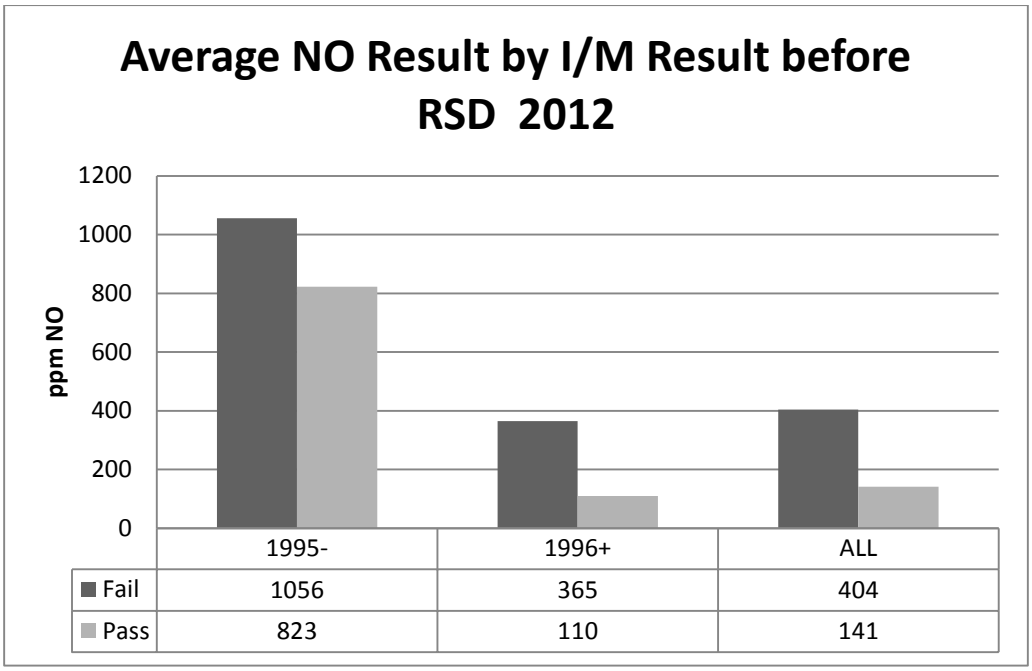
This figure shows average hydrocarbon (HC) RSD readings by model year. Increasingly more stringent EPA emission standards for newer vehicles and expected deterioration of emission controls in older vehicles result in newer vehicles having much lower emissions. The low sample sizes for the older vehicles causes considerable variation in average readings.



This figure shows average RSD readings for nitric oxide (NO) by model year. Increasingly more stringent EPA emission standards for newer vehicles and expected deterioration of emission controls in older vehicles result in newer vehicles having much lower emissions.



This figure shows average RSD HC emissions for vehicles that received an I/M test before they were observed by RSD. Results are broken down by model year and I/M pass/fail status of the last test before the RSD observation. RSD emission levels for vehicles that failed their I/M test were much higher than emission levels for vehicles that passed.



This figure shows average RSD NO emissions for vehicles that received an I/M test before they were observed by RSD. Results are broken down by model year and I/M pass/fail status of the last test before the RSD observation. RSD emission levels for vehicles that failed their I/M test were much higher than emission levels for vehicles that passed.

Emission Reduction Estimates Based on Remote Sensing Device (RSD) Readings

Emission reductions from the I/M program were estimated based on RSD emission levels for vehicles that received an I/M test before they were observed by RSD. Please note that these estimated emission reductions are extremely limited and should only be used as a rough assessment for the program. Results of remote sensing tests do not correlate well with mass emissions tests and cannot be compared to estimates based on mass emissions tests, but are directionally consistent with mass emission tests. The sample sizes are too small to make an accurate calculation of emission reductions for the I/M program. This comparison is mainly useful in determining if the program appears to be getting the benefits calculated by the MOVES model.

DEEP provided output data files from MOVES runs for 2011. DEEP estimated statewide emissions for I/M and non I/M cases. dKC limited the output to running exhaust emissions from light-duty vehicles. HC and NOx emissions are the primary concerns due to their role in forming ozone. HC benefits based on remote sensing tests are somewhat lower than predicted by MOVES, while NOx benefits are slightly higher.

Emission Reductions Based on RSD Readings Compared to MOVES

No I/M MOVES (Tons/Year Running Exhaust)			
Source Type	**HC**	**CO**	**NOx**
Passenger Car	1,650	49,974	8,746
Passenger Truck	1,774	49,267	10,274
Light Commercial Truck	773	16,596	4,703
ALL	4,197	115,837	23,722
I/M MOVES (Tons/Year Running Exhaust)			
Source Type	**HC**	**CO**	**NOx**
Passenger Car	1,348	42,583	7,285
Passenger Truck	1,480	42,372	8,990
Light Commercial Truck	692	14,755	4,359
ALL	3,520	99,710	20,634
% Reduction From I/M MOVES			
Source Type	**HC**	**CO**	**NOx**
Passenger Car	18%	15%	17%
Passenger Truck	17%	14%	12%
Light Commercial Truck	10%	11%	7%
ALL	16%	14%	13%
% Reduction From I/M Based on RSD			
Source Type	**HC**	**CO**	**NOx**
ALL	11%	15%	16%

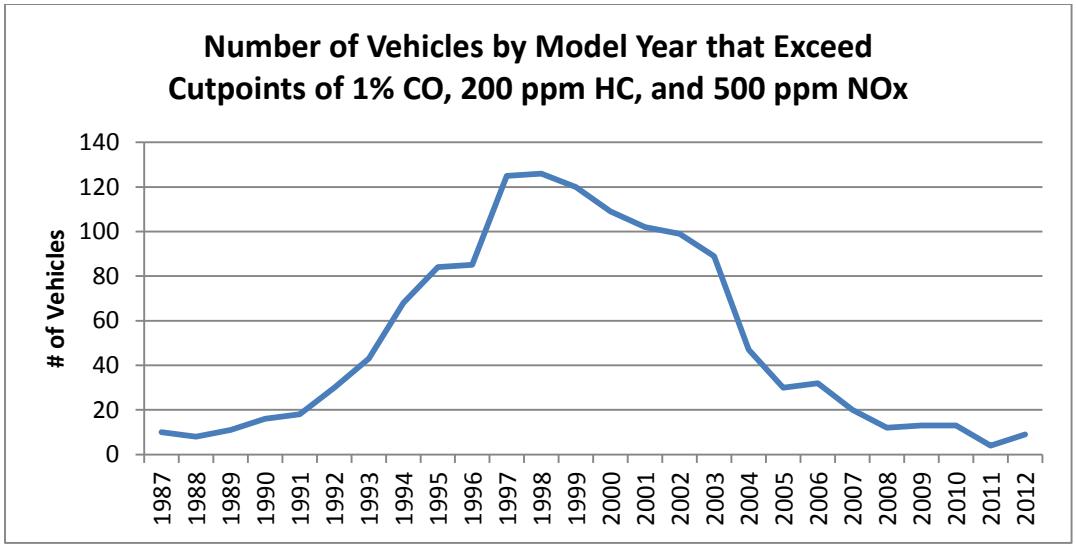
Conclusion: Analysis of RSD indicates that Connecticut's I/M program is yielding emission reductions predicted by MOVES.

Emission Levels for 2009 and Newer Vehicles

Currently, Connecticut exempts the newest four model years from the I/M program. In November 2012, when RSD measurements were made, the newest complete model year tested was 2008. Data on 2009 and newer vehicles that received RSD emissions tests were analyzed to determine if there would be value in reducing the number of model year exemptions.

Out of 2,446 tests, there were no cases of 2009 or newer models having CO > 6%, which some states use as criteria to define a gross polluter. There were few 2009 and newer vehicles that exceeded emissions levels comparable to ASM2525 cutpoints. ASM2525 pass/fail criteria for the latest models is approximately CO > 1%, HC > 200 ppm, or NO > 500 ppm. Of the total number of vehicles that exceeded these pass/fail criteria, only 3% were 2009 and newer vehicles, even though 27% of the vehicles tested were 2009 and newer models.

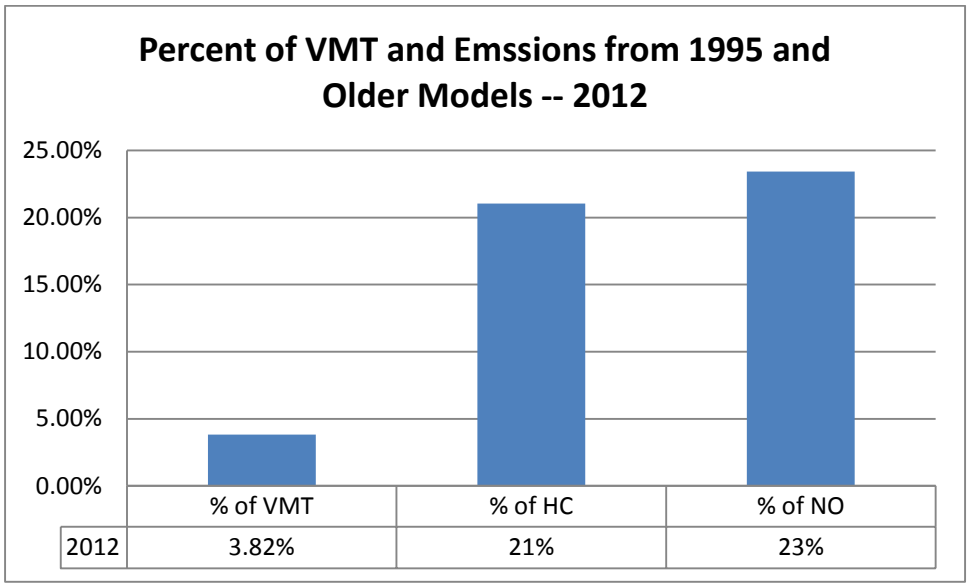
Conclusion: Connecticut's policy of exempting the newest four model years from I/M compliance does not significantly impact the benefits from the program.



This figure shows the number of vehicles by model year that exceed cutpoints of 1% CO, 200 ppm HC, and 500 ppm NO. These cut points are similar to ASM2525 cutpoints for late model light-duty vehicles. These data indicate that most high emitting vehicles are 2008 and older models, which are the models included in the current program. The numbers of high emitting vehicles drop off for 1992 and older models because far fewer of them are still being driven.

Contribution of 1995 and Older Vehicles to Total Vehicle Emissions

Results of the 2012 RSD survey were used to estimate the contribution of 1995 and older models – the models that get tailpipe tests – to total vehicle emissions. Total RSD emissions levels by model year were calculated to estimate the impact of pre-1996 vehicles on total vehicle emissions. The number of observations by model year were calculated to estimate vehicle miles travelled (VMT) by model year. As the following figure shows, 1995 and older models account for a significant fraction of vehicle emissions, even though they account for a small percentage of total VMT. The State will benefit from continuing to perform tailpipe tests on older models.



This figure shows VMT and emissions for pre-1996 vehicles as a percent of total emissions. Older models account for a significant fraction of vehicle emissions, even though far fewer of them were seen in the survey. Currently, pre-1996 vehicles account for 21% of the HC emissions and 23% of the NOx emissions, based on the 2012 RSD survey.

Conclusion: Connecticut's air quality benefits from performing tailpipe emissions tests on 1995 and older models since these vehicles are estimated to continue to contribute appreciable emissions in the future. Including these vehicles in the I/M program ensures that high emitting vehicles are identified and repaired and is necessary to comply with Clean Air Act requirements and statutory restrictions.

7.0 Assessment of OBD Testing Issues

Vehicles with Readiness Issues that are Not Currently Exempted from Readiness Requirements

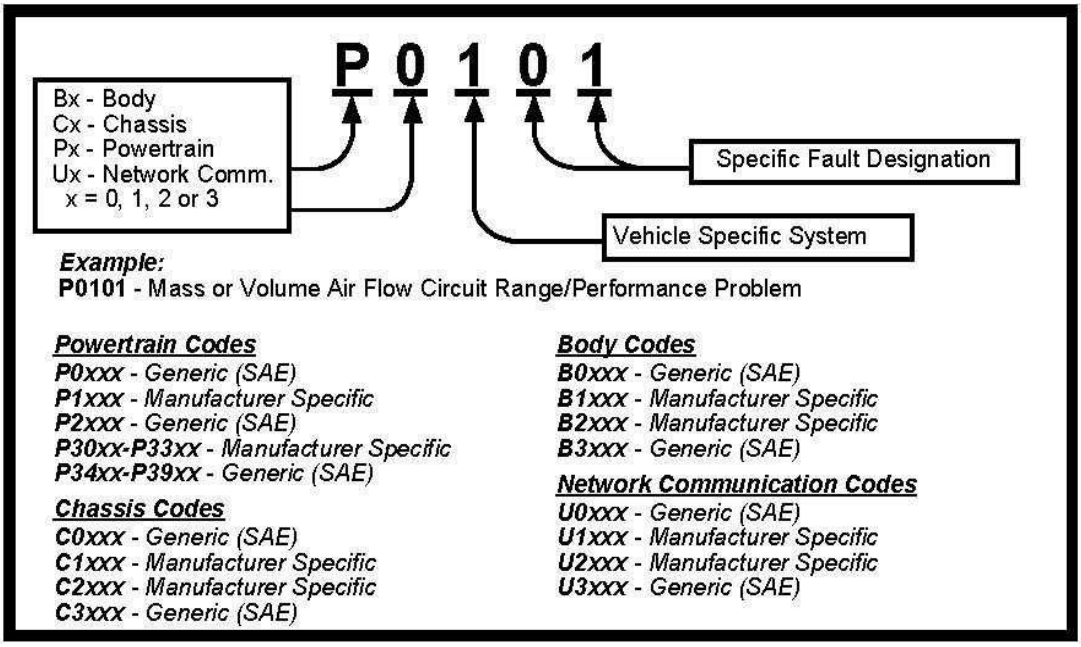
EPA allows states to exempt vehicles from readiness requirements, if they have design flaws that cause them to frequently fail for readiness. In 2007, Connecticut updated its readiness exemption list to include vehicles that had extremely high not ready rates. Based on data from tests performed in 2012, no additional vehicle models need to be added to the readiness exemption list. ***Connecticut does not need to update its readiness exemption list at this time.***

Vehicles That Fail to Communicate with Connecticut's Test System

A small percentage (0.4%) of the vehicles with OBDII systems fail to communicate with Connecticut's inspection system. This is much lower than the no-communication rate observed with the old testing equipment in 2011 and earlier years, indicating that the new OBD inspection equipment works well. In 2012, no specific models had high no-communication rates.

Diagnostic Trouble Codes (DTCs) Recorded in OBDII Failures

The Malfunction Indicator Light (MIL) is part of the OBD system and is used to alert the driver of a potential issue with the vehicle's computerized engine management system. Whenever the MIL is illuminated a Diagnostic Trouble Code (DTC) should be stored in the vehicle's computer. DTCs describe the problem that caused the MIL to go on. Before OBDII, each manufacturer had their own specific trouble code list and code definitions. Under the OBDII requirements, all manufacturers must comply with a standardized convention for DTCs. The universal DTC format consists of a 5-character alphanumeric code, consisting of a single letter character followed by four numbers. The following is an example of the standardized coding for DTCs.



Top 10 DTCs in Connecticut

Following is a list of the most prevalent DTCs in Connecticut in 2011 and 2012. This table lists the ranking of the most prevalent DTCs along with the frequency of its occurrence, expressed as a percentage. Note that the top 10 DTCs are present in about 64% of the MIL-on cases in 2012, even though there are over 1000 possible DTCs. The rankings are nearly identical in both years.

Connecticut's Top 10 DTCs				
	2011		2012	
DTC	Rank	%	Rank	%
P0420 – Low Catalyst Efficiency	1	12.55%	1	12.86%
P0171 -- System Too Lean: Bank 1	2	8.06%	2	7.96%
P0455 -- Evaporative Emission Control System Leak Detected (gross leak)	4	7.14%	3	7.60%
P0442 -- Evaporative Emission Control System Leak Detected (small leak)	3	7.38%	4	7.47%
P0300 -- Random Misfire	6	4.79%	5	5.34%
P0401 – Exhaust Gas Recirculation (EGR) Flow Insufficient	5	4.92%	6	4.85%
P0174 -- System Too Lean: Bank 2	8	4.46%	7	4.59%
P0141 -- 02 Sensor Heater Circuit Malfunction	9	4.23%	8	4.51%
P0440 -- Evaporative Emission Control System Malfunction	7	4.55%	9	4.29%
P0135 -- 02 Sensor Heater Circuit Malfunction	10	3.83%	10	4.15%
Total		61.92%		63.62%

8.0 Program Enhancements in 2012 and in the Future

DEEP and DMV evaluate Connecticut's I/M program to ensure that it continues to operate accurately and effectively while assuring air quality benefits are achieved. In 2011, DMV executed a new contract to upgrade the I/M program. The new program continues to perform tailpipe tests on pre-1996 vehicles, which do not have OBD systems. This will maintain the air quality benefits necessary to meet Clean Air Act requirements and statutory restrictions.

The new program upgraded the inspection equipment. A new type of bench, which is known to be more reliable, was utilized, resolving the high rate of equipment (gas) auditing failures. The OBDII interface has much lower no-communication rates than the old interface. The vendor will supply the vehicles for covert auditing, with DMV staff continuing to conduct the auditing procedures.

Connecticut will continue with stringent quality assurance and fraud detection activities. In addition to conducting ongoing assessments of the I/M program, Connecticut will seek out additional opportunities to increase the effectiveness of the program. For example, the next generation Connecticut Vehicle Inspection Program will place additional emphasis on the training and evaluation of the effectiveness of the role of the repair industry in overall program compliance.

The following enhancements to the Emissions Program were implemented in 2012:

1. The time extensions policy was changed to disallow a vehicle owner from receiving numerous time extensions, except for special circumstances, such as out of state vehicle owner in the military or college. Across the board multiple extensions for every situation have been eliminated.
2. Iris Enrollments are now done by Applus.
3. Iris enrollment prompts are now included in CDAS. An Iris scan cannot be replaced by badge use without previously calling in a work order and the CTI will be locked out without such a work order. The work order and lockout are not automatic. The CTI is prompted by a screen message to call in a work order if the iris enrollment feature is not functional.
4. VIN enforcement now includes more safeguards to ensure correct VIN is entered.
5. An evaluation of safeguards is being conducted to improve the accuracy of the GVWR that is entered through the registration process.
6. A video of the test is now stored with test record.
7. More cameras are being used per lane. Now there are a total of four (3 plus iris), previously there were a total of 3 (2 plus iris).
8. New monitoring with an engine temperature sensor ensures the vehicle is warmed up prior to receiving a tailpipe test.

9. The Testing Reciprocity document with other states was updated. Reciprocity is limited to one inspection cycle except for military and college students.

10. The Dashboard is now equipped with automated audit and includes:

a. Reports

- Official Test Report
- Notification Letters Report
- Offline By Test Center Report
- Video Streaming
- Consecutive No Communications Report
- Weather Station Report
- Calibration Reports
- VIR Reprint
- Aborted / Incomplete Test Report
- TSI Cutpoint Report
- Inventory Adjustment Report

b. Test Center Documents

- CDAS Materials
- Fast Fact Messages
- Certified Emissions Repair Technicians (CERT)
- Test Center Materials
- Certified Testing Inspector (CTI) Form
- Training Materials

c. Non-Compliance

- Software Version Compliance
- Vehicles with GVWR>8,500 Pounds
- Monitor Mismatches
- Inspector ID Entry
- Software Version Non-Compliance
- All OBD Monitors Display Unsupported

- OBD Short Time Tests <= ½ Hour
- VIN Entry Type
- Offline Test Rates
- OBD VIN Mismatch
- A/C Monitor Ready or Not Ready
- ASM Short Time Test <= ½ Hour
- PID and PCM Mismatches
- Aborted Inspection

11. Stations and CTIs are locked out of the system if penalties assessed by Applus according to the contract/station participation agreement schedule of infractions, as established in the Compliance Action Plan, are not received.
12. Challenge test process has been streamlined to ensure the equipment is functioning properly. The procedure now entails first contacting Applus to verify the proper operation of equipment.
13. More diesel test station locations have been brought into the program.
14. CO detectors are now required at all test facilities.
15. System lockouts now occur for weather station anomalies.
16. Equipment tamper/malfunctions generate an automatic email notifications.
17. DSL or faster internet connection is now required for test equipment.
18. Every CTI was retrained prior to the start of the new program.
19. Emissions staff is now all centrally stationed in Wethersfield to improve logistics.
20. The fleet testing program is being reviewed especially with respect to training and maintenance.
21. Cameras with higher megapixel resolution are now being used.
22. DMV now has access directly to the enhanced comprehensive Work Order database, which enhances review.
23. The Work Order database now indicates all work orders.
24. Work Order database now indicates test type affected.
25. There is new guidance for issuing waivers, including how the nature of the repair has to equate to the reason for failure.
26. Presently revising the CTI training manual to allow for DMV review of training evaluations as a tool to modify and amend the training to increase efficiency. The new manual also is intended to be used for oversight of equipment malfunction.

9.0 Conclusions

Key conclusions from this analysis:

- Connecticut is failing the expected number of vehicles. Overall, 11% of the vehicles tested failed inspection in 2012.
- Over 98% of the vehicles subject to I/M requirements comply with standards. 30% of the vehicles that failed in the first two months of 2012 did not receive a passing result or waiver by the end of 2012. Ultimately these vehicles must comply with I/M requirements, since compliance with I/M standards is a prerequisite to vehicle registration. The enforcement of Connecticut's I/M program exceeds the enforcement levels assumed in emissions modeling for the Connecticut SIP.
- While Connecticut did not meet the required number of covert audits in this inspection cycle due to extenuating circumstances, Connecticut's actions nonetheless demonstrate substantial compliance with EPA's recommended levels of quality assurance. When video audits are counted as covert audits, which they are, Connecticut exceeds EPA's covert audit requirements. The program performs accurate inspections and there's virtually no fraud.
- Connecticut conducts extensive compliance assurance activities on the I/M program. Connecticut is a national model for other states' enforcement activities.
- Connecticut's new I/M contract is designed to ensure the I/M program continues to effectively achieve the expected air quality benefits. Challenges associated with some of the existing protocols have been resolved with the full implementation of the new program.

Appendix A
EPA Checklist

Appendix A:
40 CFR Part 51 - Subpart S Inspection/Maintenance Program Requirements
51.366 - Data Analysis and Reporting Requirements

Reporting Requirement	**Reviewer Comments / Location in State Report**	**Has the State Met the Requirement?**
(a) Test Data Report The program shall submit to EPA by July of each year a report providing basic statistics on the testing program for January through December of the previous year, including:		
(1) The number of vehicles tested by model year and vehicle type;		
(2) By model year and vehicle type, the number and percentage of vehicles:		
(i) Failing initially, per test type;		
(ii) Failing the first retest per test type;		
(iii) Passing the first retest per test type;		

Reporting Requirement	**Reviewer Comments / Location in State Report**	**Has the State Met the Requirement?**
(iv) Initially failed vehicles passing the second or subsequent retest per test type;		
(v) Initially failed vehicles receiving a waiver; and		
(vi) Vehicles with no known final outcome (regardless of reason). *(vii)-(x) [Reserved]*		
(xi) Passing the on-board diagnostic check;		
(xii) Failing the on-board diagnostic check;		
(xiii) Failing the on-board diagnostic check and passing the tailpipe test (if applicable);		
(xiv) Failing the on-board diagnostic check and failing the tailpipe test (if applicable);		
(xv) Passing the on-board diagnostic check and failing the I/M gas cap evaporative system test (if applicable);		
(xvi) Failing the on-board diagnostic check and passing the I/M gas cap evaporative system test (if applicable);		

Reporting Requirement	Reviewer Comments / Location in State Report	Has the State Met the Requirement?
(xvii) Passing both the on-board diagnostic check and I/M gas cap evaporative system test (if applicable);		
(xviii) Failing both the on-board diagnostic check and I/M gas cap evaporative system test (if applicable);		
(xix) MIL is commanded on and no codes are stored;		
(xx) MIL is not commanded on and codes are stored;		
(xxi) MIL is commanded on and codes are stored;		
(xxii) MIL is not commanded on and codes are not stored;		
(xxiii) Readiness status indicates that the evaluation is not complete for any module supported by on-board diagnostic systems;		
(3) The initial test volume by model year and test station;		
(4) The initial test failure rate by model year and test station; and		

Reporting Requirement	Reviewer Comments / Location in State Report	Has the State Met the Requirement?
(5) The average increase or decrease in tailpipe emission levels for HC, CO, and NOX (if applicable) after repairs by model year and vehicle type for vehicles receiving a mass emissions test.		
(b) Quality assurance report. The program shall submit to EPA by July of each year a report providing basic statistics on the quality assurance program for January through December of the previous year, including:		
(1) The number of inspection stations and lanes:		
(i) Operating throughout the year; and		
(2) The number of inspection stations and lanes operating throughout the year:		
(i) Receiving overt performance audits in the year;		
(ii) Not receiving overt performance audits in the year;		
(iii) Receiving covert performance audits in the year;		

Reporting Requirement	Reviewer Comments / Location in State Report	Has the State Met the Requirement?
(iv) Not receiving covert performance audits in the year; and		
(v) That have been shut down as a result of overt performance audits;		
(3) The number of covert audits:		
(i) Conducted with the vehicle set to fail per test type;		
(ii) Conducted with the vehicle set to fail any combination of two or more test types;		
(iii) Resulting in a false pass per test type;		
(iv) Resulting in a false pass for any combination of two or more test types;		
(4) The number of inspectors and stations:		
(i) That were suspended, fired, or otherwise prohibited from testing as a result of covert audits;		
(ii) That were suspended, fired, or otherwise prohibited from testing for other causes; and		

Reporting Requirement	Reviewer Comments / Location in State Report	Has the State Met the Requirement?
(iii) That received fines;		
(5) The number of inspectors licensed or certified to conduct testing;		
(6) The number of hearings:		
(i) Held to consider adverse actions against inspectors and stations; and		
(ii) Resulting in adverse actions against inspectors and stations;		
(7) The total amount collected in fines from inspectors and stations by type of violation;		
(8) The total number of covert vehicles available for undercover audits over the year; and		
(9) The number of covert auditors available for undercover audits.		

Reporting Requirement	Reviewer Comments / Location in State Report	Has the State Met the Requirement?
(c) Quality control report The program shall submit to EPA by July of each year a report providing basic statistics on the quality control program for January through December of the previous year, including:		
(1) The number of emission testing sites and lanes in use in the program;		
(2) The number of equipment audits by station and lane;		
(3) The number and percentage of stations that have failed equipment audits; and		
(4) Number and percentage of stations and lanes shut down as a result of equipment audits.		

Reporting Requirement	Reviewer Comments / Location in State Report	Has the State Met the Requirement?
(d) Enforcement report. (1) All varieties of enforcement programs shall, at a minimum, submit to EPA by July of each year a report providing basic statistics on the enforcement program for January through December of the previous year, including:		
(i) An estimate of the number of vehicles subject to the inspection program, including the results of an analysis of the registration data base;		
(ii) The percentage of motorist compliance based upon a comparison of the number of valid final tests with the number of subject vehicles;		
(iii) The total number of compliance documents issued to inspection stations;		
(iv) The number of missing compliance documents;		
(v) The number of time extensions and other exemptions granted to motorists; and		

Reporting Requirement	Reviewer Comments / Location in State Report	Has the State Met the Requirement?
(vi) The number of compliance surveys conducted, number of vehicles surveyed in each, and the compliance rates found.		
(2) Registration denial based enforcement programs shall provide the following additional information:		
(i) A report of the program's efforts and actions to prevent motorists from falsely registering vehicles out of the program area or falsely changing fuel type or weight class on the vehicle registration, and the results of special studies to investigate the frequency of such activity; and		
(ii) The number of registration file audits, number of registrations reviewed, and compliance rates found in such audits.		
(3) Computer-matching based enforcement programs shall provide the following additional information:		
(i) The number and percentage of subject vehicles that were tested by the initial deadline, and by other milestones in the cycle;		

Reporting Requirement	Reviewer Comments / Location in State Report	Has the State Met the Requirement?
(ii) A report on the program's efforts to detect and enforce against motorists falsely changing vehicle classifications to circumvent program requirements, and the frequency of this type of activity; and		
(iii) The number of enforcement system audits, and the error rate found during those audits.		
(4) Sticker-based enforcement systems shall provide the following additional information:		
(i) A report on the program's efforts to prevent, detect, and enforce against sticker theft and counterfeiting, and the frequency of this type of activity;		
(ii) A report on the program's efforts to detect and enforce against motorists falsely changing vehicle classifications to circumvent program requirements, and the frequency of this type of activity; and		
(iii) The number of parking lot sticker audits conducted, the number of vehicles surveyed in each, and the noncompliance rate found during those audits.		

Reporting Requirement	Reviewer Comments / Location in State Report	Has the State Met the Requirement?
(e) Additional reporting requirements. In addition to the annual reports in paragraphs (a) through (d) of this section, programs shall submit to EPA by July of every other year, biennial reports addressing:		
(1) Any changes made in program design, funding, personnel levels, procedures, regulations, and legal authority, with detailed discussion and evaluation of the impact on the program of all such changes; and		
(2) Any weaknesses or problems identified in the program within the two-year reporting period, what steps have already been taken to correct those problems, the results of those steps, and any future efforts planned.		

Appendix B
2012 CT I/M Program Data

Appendix B
2012 CT I/M Program Data

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